DETERMINANTS, CONSEQUENCES AND A POLICY RESPONSE TO PRIVATE CAPITAL FLOWS IN DEVELOPING COUNTRIES

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LES DETERMINANTS, LES CONSEQUENCES ET LA GESTION DES FLUX DE CAPITAUX PRIVES DANS LES PAYS EN DEVELOPPEMENT

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Chapter 1: General Introduction and Overview

Sustaining economic growth and pursuing a development agenda require considerable domestic resource mobilization as well as external finance. With limited and hardly predictable public flows, private capital flows have a major role in financing development needs. Private flows to developing countries help smoothing spending throughout the business cycle by financing saving gaps. Private flows also increase investments, contributing to higher economic growth and economic development in the recipient countries. For instance, a major component of private capital flows, the foreign direct investment is recognized to have beneficial effects on local firms and the economy at large. FDI gives more resources, facilitates technological and managerial knowledge transfers to the host countries, develops their international import and export network, creates job opportunities, and promotes economic growth. Policy makers often seek to attract external resources to finance savings gaps but also for their potential to generate growth and promote economic development (Dornbusch, 1998). This is an important issue in economics, business, and politics which calls for further analysis of the forces driving private flows and their potential consequences on the recipient economies.

Beyond their expected benefits, capital inflows also create important challenges for policy makers because of their potential to create macroeconomic instability and weaken the financial system. During the last three decades, the international economy has been largely marked by financial crises. The national and international economic environment contributed to these episodes of economic stagnation, but the destination and composition of private capital flows were also important factors. For instance, the lending boom following capital inflows episodes could reinforce the vulnerability of the financial system through bubbles in asset prices. Macroeconomic overheating following capital inflows could be in the form of an acceleration of economic growth and inflation, or a loss of competitiveness associated with the appreciation of the real exchange rate. Real exchange rate appreciation jeopardizes export competitiveness, widens the current account deficit, and increases the vulnerability to financial crises.

Developing countries often implement various policies to avoid the negative impact of private capital flows; for instance policies aiming to dampen the real appreciation of

the exchange rate due to capital inflows. The available policy responses include macroeconomic policies such as sterilization, exchange rate flexibility, and fiscal tightening as well as more structural policies such as capital controls, trade liberalization, and better regulation and supervision of the financial system.

All these issues remain contentious and the solutions offered in the empirical literature are inconclusive, raising the importance to reassess them. Within this framework, this dissertation aims to analyze empirically the forces driving private capital flows, their consequences on recipient countries' competitiveness, and an effective policy response to manage capital inflows. Before dealing with each of these issues (chapter 2 to chapter 5), the following sections briefly present the main data issues on capital flows, some stylized facts on these flows, and the outline and main results of this dissertation.

1. Data issues

There are two main data sources on external flows. A database can be constructed using borrowers or lenders data. On one hand, the main databases compiled by the IMF -the World Economic Outlook (WEO) and the Balance of Payments Statistics Yearbook (BOPSY)- come from the data reported by debtor countries. On the other hand, aid flows published by the Organization for Economic Co-Operation and Development (OECD) originate from the Development Agency Committee (DAC) members, which are the creditors. In its publication Global Development Finance (GDF), the World Bank mixes the two different data sources. Public and publicly guaranteed debt data are provided by member countries (the debtors) through the Debt Reporting System, while the short-term debt of some countries are derived from creditor sources (such as data on officially guaranteed suppliers' credits compiled by the OECD) and lending from multilateral institutions and government lending agencies are confirmed by creditors' statements and reports. The provision and the related-recording of debt relief in national accounts complicate the manipulation of data. Debt relief can be recorded in various ways depending on the creditors' choice of the vehicle to provide it and the methodological choice of the authorities. Thus, it is critical to understand how debt relief is treated to ensure that the database covers all debt relief flows to derive net transfers on debt accurately. All theses complexities lead

to different definitions and estimations of external public flows across databases (box 1).

The nature and composition of private sector flows are less subject to different treatment, definition, or interpretation (box 1). Most databases capture the net position of the main aggregates -liabilities are deducted from assets. Even though some discrepancies persist[1], private capital flows are relatively homogeneous across databases. Dorsey et al. (2008) show that correlation coefficients between private liabilities are above 0.6 during the period 1990-2000. During the same period, the authors also find that the correlation across databases is the highest for FDI flows (between 0.97 and 1). The correlation for other private flows (portfolio investment and other investment) is between 0.7 and 0.8[2]. The BOPSY/IFS data are severely plagued by missing observations while the GDF and WEO databases include much more information. This is because these two databases (WEO and GDF) use staff estimates to complete some missing observations. This dissertation focuses on the analysis of private capital flows and uses the WEO and GDF databases.

[1] Some datasets focus on long-term capital flows, while others expand the spectrum of flows and include short-term flows.

[2] See Dorsey et al. (2008) for a comprehensive analysis of private capital flows consistency across different databases.

Box 1. Definition and Coverage of External Financing Across Databases

The databases include the IMF World Economic Outlook (WEO) database, Balance of Payments Statistics Yearbook (BOPSY) database, and International Financial Statistics (IFS) database; the World Bank Global Development Finance (GDF) database; and the Development Agency Committee (DAC) of the OECD database.

Net inflows to the public-sector can be derived using:

WEO: Net debt flows to the public sector are estimated by summing up net liabilities to official debtors, debt forgiveness, and official debt securities, and deducting interest payments on external debt. Aggregated flows can be derived by adding current public transfers to net debt flows.

BOPSY: Public flows are calculated by adding current public transfers, debt forgiveness, official debt securities (being the sum of portfolio net liabilities to monetary authorities and the general government in form of bonds and notes and money market instruments) and net liabilities to official debtor (being the sum of other investment net liabilities in form of trade credits, loans and other liabilities to the general government; and other investment net liabilities in form of loans, currency and deposits, and other liabilities to monetary authorities).

GDF: This database provides disaggregated data on net resources flows on debt (loan disbursements minus principal repayments) and net transfers on debt (net resources flows on debt minus interest payments) by types of creditors. Grants (excluding technical cooperation grants) can be added.

DAC: It compiles Official Development Assistance (ODA) flows provided by DAC members. The flows are the sum of net ODA loans disbursements and ODA grants disbursements (the provision of debt relief is recorded through grants).

Net inflows to the private-sector can be derived using:

WEO: External financing to the private sector is the sum of direct investment in reporting economy, foreign purchases of equities of domestic companies, debt instruments issued by the domestic private sector, other investment liabilities to the private sector, and private current transfers.

BOPSY/IFS: Estimates of flows to the private sector are derived by adding direct investment in the reporting economy, portfolio investment liabilities (in form of equity and debt securities to the private sector), other private investment liabilities (the difference between other investment liabilities and net liabilities to the official debtors), and private current transfers.

GDF: Private sector flows are calculated by adding foreign direct investment, portfolio equity flows, bank and trade related lending, and workers' remittances.

2. Stylized facts of private capital flows to developing countries

Since the Second World War, developing countries experienced three major episodes of surge in private capital inflows. The first one is associated with the oil price boom of the 1970s and the subsequent significant foreign investment in form of bank loans from oil exporting countries. It has been followed by a crisis of national debt in the beginning of the 1980s; the consequence of borrower countries unable to pay back their loans. The second surge in private capital inflows occurred in the aftermath of the debt crisis, during the second half of the 1980s. This second episode ended with two main financial crises: the Mexican crisis in 1994 and the Asian crisis in 1997. The third wave of private capital inflows is a shorter one. This wave started in the beginning of the 2000s and is expected to end with the current global financial and economic crisis triggered by the US mortgage market and the collapse of major financial institutions such as Lehman Brothers.

Figures 1.1 and 1.2 illustrate the evolution of private capital inflows to developing countries in absolute value and as a percentage of GDP, using WEO data.

Figure 1.1: Private capital flows to developing countries (in billion of US$)

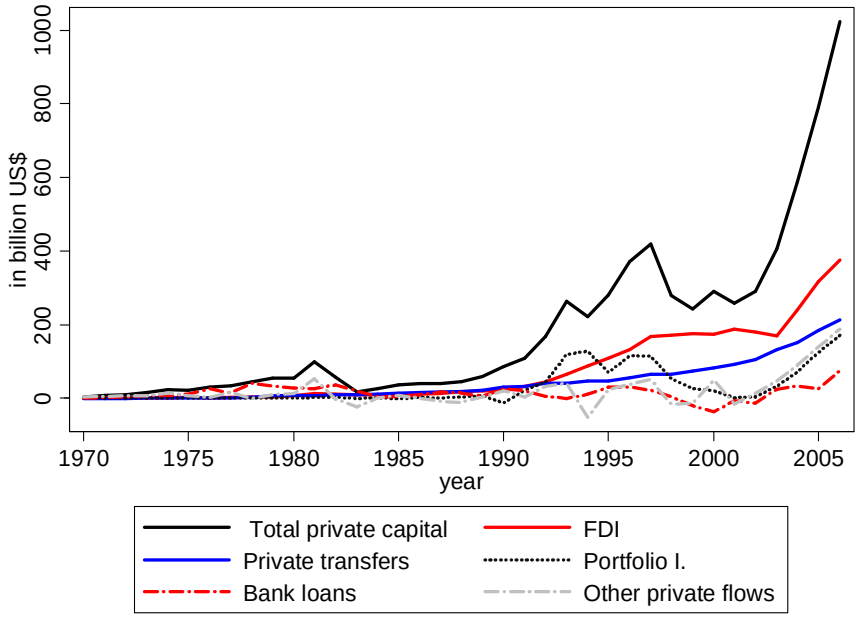


Figure 1.2: Private capital flows to developing countries (in percent of GDP)

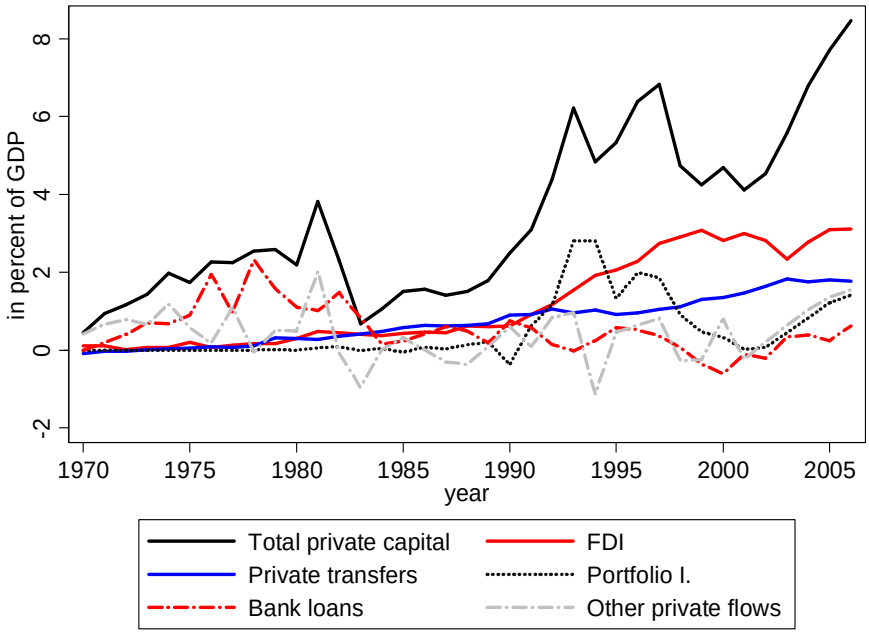


Figure 1.1 indicates that private capital flows[3] to developing countries have risen from an almost null value to approximately 100 billion US dollar during the first wave (from 1970 to the beginning of the 1980s). In relative term, this represents a rise from 0.4 percent of GDP to almost 4 percent of GDP (figure 1.2). During this episode, private flows are mainly in form of banks loans. The observed decrease of private flows at the beginning of the 1980s illustrates the effects of the debt crisis.

Shortly after the debt crisis, developing countries observed a second wave of private capital inflows during the middle of the 1980s with private flows growing from approximately 1 percent of GDP of the recipient countries to almost 7 percent of GDP in 1997. During this second wave, FDI flows became the major component of private flows, rising from less than 1 percent of GDP to almost 3 percent of GDP and banks loans represented less than 1 percent of GDP. Portfolio investments are the major element determining this second episode of capital flows. Indeed, from almost 0

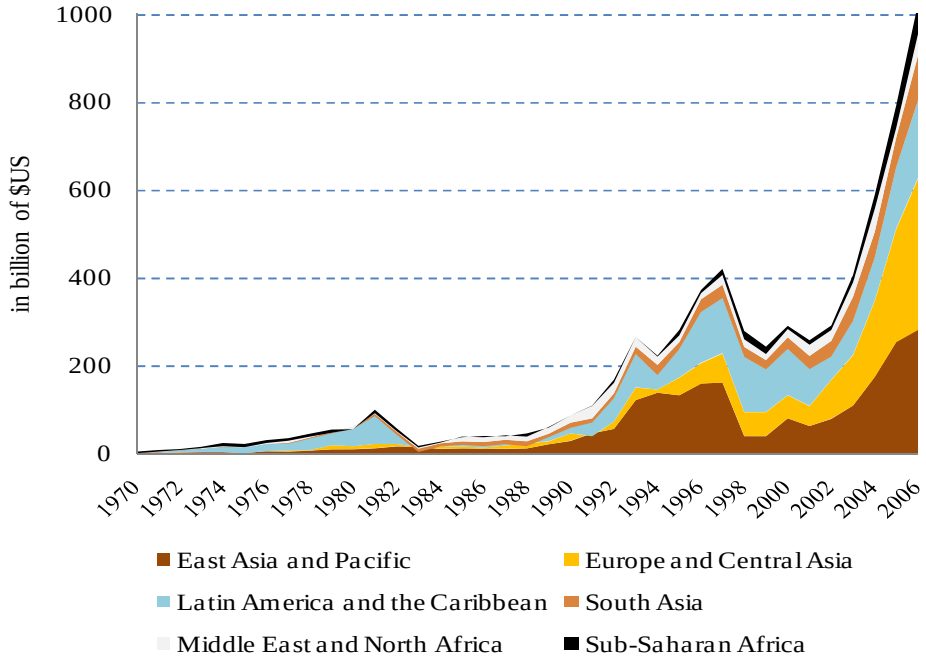
[3] Private capital flows in this section are defined as the sum of FDI, portfolio investment, bank loans, private transfers, and other private flows.

percent of GDP during the 1980s, these flows grew steadily to reach almost 3 percent of GDP before the Mexican crisis and 2 percent of GDP before the Asian crisis. The deceleration of capital inflows observed in 1994 is the effect of the Mexican crisis that was largely restricted to countries in the region and affected mainly portfolio investments. Following the Mexican crisis, a new crisis hit the Asian countries in 1997. Although portfolio investments decreased sharply during this crisis (due to the contagion between short-term capital markets), the Asian crisis was mainly due to a collapse in private debts. During these two crises, FDI and private transfers pursued a robust growth.

The figures illustrate the beginning of a third wave of private capital inflows starting in the beginning of the 2000s. This wave is particularly dominated by a surge in FDI and private transfers that are relatively stable flows. Portfolio investment and private debt also participate in this new episode. The current financial and economic crisis is expected to mark the end of this wave of private flows.

Beyond the evolution of private flows to developing countries, the distribution of these flows among the recipient countries is also important. In the developing world, some countries succeed in attracting foreign capital while others remain marginalized. Figure 1.3 illustrates rather well this unequal distribution of private flows across developing regions.

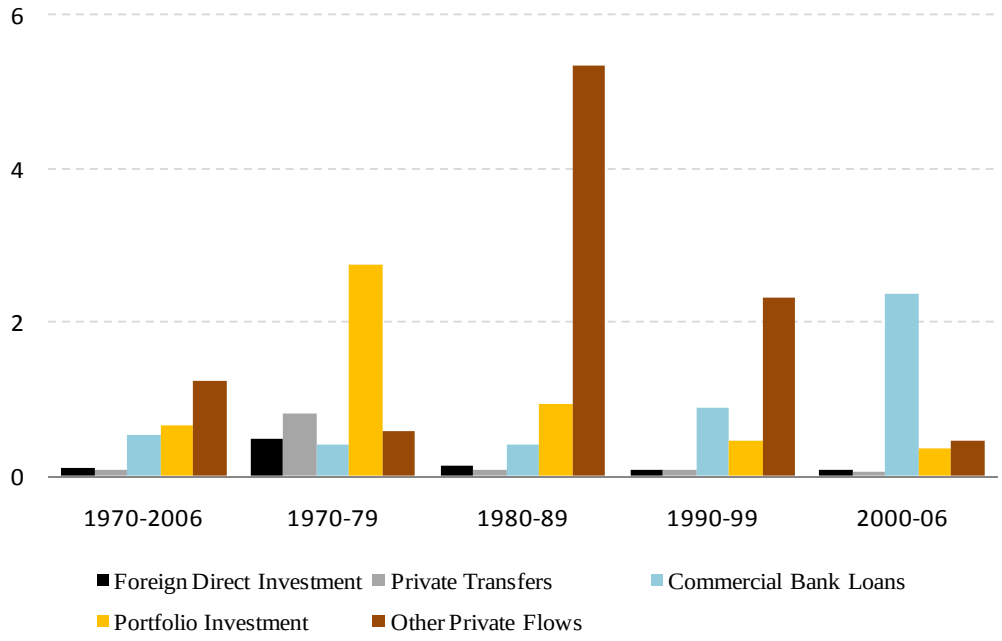
Figure 1.3: Distribution of private capital flows across developing region



Most of countries in Europe and Central Asia were independent after 1990; thus interpreting the data for these countries makes more sense after this date. Although some caution is necessary because we interpret absolute values, a general view shows that Sub-Saharan African countries receive the lowest volume of private flows followed by countries in the Middle East and North Africa region. Latin American countries attracted the main part of private flows before the debt crisis. After this crisis, East Asia and Pacific countries became the major recipients of private flows. In the aftermath of the Asian crisis, private capital flows remained mainly directed to countries in East Asia and the Pacific but European and Central Asian countries became the second major recipients, followed by Latin American and the Caribbean countries.

Private capital flows have been relatively volatile, albeit decreasingly so during the recent years. Volatility is estimated using the normalized standard deviation of de-trended inflows. Normalization is performed using the average flows during the period and the Hodrick-Prescott filter with a smoothing parameter of ten is used to de-trend the series. This method controls for the increasing trend of private flows during the last decades. Figure 1.4 illustrates the difference of volatility according to the forms of private flows.

Figure 1.4: Volatility of private capital flows



Except commercial bank loans, there is an evidence of decreasing volatility of other private flows during the last three decades. FDI and private transfers exhibit the lowest volatility level. Commercial bank loans and other private flows (trade credits, deposits, etc.) are in average twenty times more volatile than FDI and private transfers are during the 1990s and the 2000s[4]. Portfolio investments are also relatively volatile, averaging at least six times the volatility level of FDI and private transfers. The volatility of capital flows complicates their management for recipient countries. It contributes to a more instable macroeconomic environment and a higher vulnerability of economies due to the pro-cyclicality of capital inflows, particularly in developing countries.

The increasing volume of private capital inflows to developing countries, coupled with their unequal distribution across countries and region as well as the high instability of some forms of private flows raise a number of questions to which this dissertation aims to provide some insights. Why do some developing countries succeed better than

[4] The significant volatility of commercial bank loans and other private flows during the 1980s is due to the succession of inflows and significant outflows -which started in the context of banking crises in 1990.

others in attracting foreign capital? What are the potential consequences of private capital flows for recipient countries competitiveness? How could developing countries attract capital flows while avoiding the associated negative effects?

3. Outline and main results

This dissertation deals with the previously addressed questions through an empirical analysis. The first part of the dissertation analyzes the macroeconomic determinants of two forms of private flows: foreign direct investment (FDI) and portfolio investment. This analysis is completed by a firm-level study of the determinants of FDI in the manufacturing sector. In the second part, the dissertation analyzes the consequences of foreign capital for local economies. This is done through two main channels: the positive impact of foreign investment on aggregate productivity and the negative effect of capital inflows on countries' competitiveness captured by the appreciation of the real exchange rate. This second part concludes with the analysis of a main policy response to dampen the real appreciation of the exchange rate stemming from capital inflows. The next sections summarize the main findings of this dissertation.

Combining the classical "push-pull factors" and the "Lucas paradox" theoretical approaches, and controlling for the relationship between two forms of private capital flows -through Three Stage Least Square (3SLS) estimations-, the second chapter shows that physical infrastructure and financial development positively affect FDI and portfolio investment using a sample of 58 developing countries. The analysis highlights the importance of non-linearity when assessing the role of financial development for portfolio investment inflows. Indeed, a lax monetary policy and excessive credit provision could weaken the financial system and significantly reduce portfolio investment flows. This indicates the importance of sound monetary policy and strong oversight of the financial system. The results also show that for Sub-Saharan African countries, better physical infrastructure attracts more FDI.

The third chapter supports the second one by analysing (with disaggregated data) how investment climate constraints jeopardize FDI in developing countries. Using manufacturing firm-level data for 77 developing countries, this chapter provides the

first empirical analysis of the importance of the investment climate for FDI with a large sample of developing countries. FDI is characterized by the presence of at least 10% of foreign ownership in firms' capital, following the IMF standard definition. Investment climate constraints are defined by two principal factors: first, physical and financial infrastructure problems, and second, human capital constraints and institutional problems. The main results show that physical infrastructure problems, financing constraints, and institutional problems discourage FDI. An innovative breakdown analysis between exporter and non-exporter firms shows that foreign firms that supply foreign markets are more affected by physical infrastructure problems but financing constraints affect more foreign firms that supply local markets. Exporter foreign firms are also more constrained in their activity by the lack of skilled workers compared to firms supplying the domestic market. Corruption and tax rate represent obstacles for FDI but trade and customs regulations encourage FDI. This last finding follows the theory of horizontal FDI according to which foreign firms aiming to supply the local market may look for protected countries with high trade barriers, giving them price advantages. The results also highlight the importance of institutional quality for FDI in Sub-Saharan African countries. Finally, tax incentives in the manufacturing sector are relevant for developing countries other than the African ones.

While most of studies focus on the effect of aggregated or specific form of capital inflows on the real exchange rate with mixed results, the fourth chapter proposes a comprehensive analysis of the impact of different forms of private capital flows on the real exchange rate. This chapter also assesses the flexibility of the exchange rate as a hedge against the real appreciation. Based on a sample of 42 developing countries, the chapter uses the newly developed panel co-integration method (the pooled mean group estimator) that allows short-run heterogeneity while imposing long-run homogeneity of the real exchange rate determination across countries. The results show that aggregated capital inflows as well as public and private flows appreciate the real exchange rate. Among private flows, portfolio investment has the highest appreciation effect on the real exchange rate, almost seven times the appreciation level due to FDI or banks loans. FDI and bank loans are relatively more related to an increase in the productive

capacity compared to portfolio flows. Private transfers (mainly remittances) lead to the lowest appreciation of the real exchange rate compared to the other forms of private flows. This suggests more counter-cyclical remittances aiming to smooth consumption during economic slowdown. Countries often implement various policies to offset or avoid the loss of competitiveness associated with the appreciation of the real exchange rate following capital inflows. This chapter assesses the effectiveness of one of the main macroeconomic tools: the exchange rate policy. Using for the first time a *de facto* measure of exchange rate flexibility (in a real exchange rate framework), we find that allowing higher flexibility of the exchange rate dampen the appreciation of the real exchange rate stemming from capital inflows.

With a particular attention to foreign ownership, the last chapter analyzes productive performances of the manufacturing industry by considering the "one step" stochastic frontier approach where production technology and efficiency determinants are simultaneously estimated. Using manufacturing firm-level data for a sample of five developing countries, we find that average productivity scores broadly reflect international per capita GDP differences and foreign firms are more productive than local companies. Differences in infrastructure quality, in access to finance, in the availability of skilled labor, as well as in institutional quality significantly explain productivity disparities. We propose for the first time differences in the investment climate faced by foreign and local companies as major factors contributing significantly to the higher productivity of foreign firms. Indeed, foreign companies could positively influence their investment climate or locate where the investment climate is better. Adjusting efficiency to the best investment climate in each country -the investment climate faced by foreign firms- highlights efficiency gains ranging from less than 10% in South Africa to about 25% in Pakistan. In contrast with former studies that estimate spillovers effects at sector-level, we propose an innovative way to address this issue. We use, for the first time, the share of each firm's sales to multinationals located in the country to assess the importance of vertical spillovers. The results show that firms, particularly local and small-local firms selling higher part of their production to foreign companies are more productive. This illustrates the existence and the importance of vertical spillovers through backward linkages in our sample countries.

The rest of the dissertation is organized as follows: The first part analyzes the determinants of private capital flows using macroeconomic and firm-level data (chapter 2 and chapter 3). The second part investigates the consequences of private capital flows on countries' competitiveness measured by the real exchange rate and firms' aggregate productivity (chapter 4 and chapter 5). The last part proposes the general conclusion.

PART I: DETERMINANTS OF PRIVATE CAPITAL INFLOWS

Chapter 2:
Increasing Private Capital Flows to Developing Countries: The Role of Physical and Financial Infrastructure

1. Introduction

According to the neoclassical economic theory -assuming free capital markets and diminishing returns-, capital should flow from capital abundant countries (developed countries) to capital scarce countries (developing countries) leading to the equalization of marginal returns to capital. In reality, this theoretical prediction is not observed, leading to an important paradox in international macroeconomics: the "Lucas paradox". Private capital flows are important in financing development, especially in the context of insufficient and unstable aid, which makes it crucial to understand why the neoclassical theory is not observed. Why does capital not flow to developing countries where their marginal return is higher? Answering this question requires the study of the determinants of private capital flows. For foreign private capital, we consider net flows of FDI, portfolio investments and debts.

Following the Asian crisis, a number of studies on the determinants of private capital flows emerged. These studies were generally based on an approach that distinguishes between external determinants (exogenous to the economy receiving capital, or "push factors") and internal determinants[5] (under the recipient economy's control, or "pull factors"). The analysis of external factors explains how the economic conditions of capital-exporting countries (developed countries) influences capital inflows in developing countries. These external factors reflect the opportunity cost of investment in these countries. The international interest rate and world growth rates, generally approximated by those of the United States, are the most influential factors. Low profit in developed countries is a significant cause of capital flows to developing countries where profits' prospects can be more promising. One of the first analyzes of private capital flows determinants was made by Calvo, Leiderman and Reinhart (1993). Using a sample of 10 Latin American countries over the period 1988-1991, they find that

[5] Studies also focus on contagion during episodes of surges in private capital flows between large countries and their smaller neighbours who benefit from externalities resulting from the high attractiveness of the large countries (Calvo et al.. 1996, Hernandez, Medallo, and Valdes 2001). A competition between countries of the same area for better attractiveness to private capital flows could also happen (Kang and al., 2003).

capital flows are mainly influenced by the external factors, namely the growth rate and the interest rate of developed countries. Many authors showed the importance of the external factors (international interest rate and international growth rate) in determining private capital flows (Calvo et al., 1996; Fernandez-Arias, 1996; Montiel and Reinhart, 1999; Kim, 2000; Ying and Kim, 2001; Ferrucci et al., 2004). A greater number of studies revealed the dominant role of internal factors (macroeconomic conditions of the recipient country) in the explanation of private capital inflows (Root and Ahmed, 1979; Schneider and Frey, 1985; Fernandez-Aria, 1996; Ahn et al., 1998; Gastanga et al., 1998; Asiedu, 2002). Internal factors are the macroeconomic conditions of the recipient country that influence private capital flows to this country. A stable macroeconomic environment is favourable to investment decisions, creation of value added, and productivity. Internal factors include economic growth rate, inflation, trade openness, education, and political stability, which can be influenced by national-level policies. Studies that are more recent use the "Lucas paradox" to explain the determinants of private capital flows[6]. Following Lucas, these studies differentiate the determinants of capital flows into economic fundamentals with the ability to affect the production structure (education, institutions, and so forth) and capital market imperfections (mainly informational asymmetry). Alfaro et al. (2006a, 2006b), through a cross-sectional study, find that the "Lucas paradox" is explained by the quality of institutions, education, inflation and financial development. According to Reinhart and Rogoff (2004), the "Lucas paradox" exists because of political risk and credit market imperfections. Reinhart and Rogoff (2004) argue that the reduction of credit market imperfections through better institutions would allow externalities, in particular those related to the human capital, to play a more significant role. Recent studies also illustrated the importance of business environment for private capital flows (Martin and Rose-Innes, 2004; Asiedu, 2006; Naudé and Krugell, 2007; Bénassy-Quéré et al. 2007; IMF, 2007; IMF, 2008).

[6] A very recent approach, applied to emerging countries, consists in the estimation of a model of supply and demand of capital flows. Then using the maximum likelihood method, this approach estimates the probability of disequilibrium between supply and demand of capital (Mody and Taylor, 2004).

All of these studies lead to different conclusions about the factors which significantly influence private capital inflows to a country. Another crucial element to attracting FDI is building industrial capacity. This includes developing infrastructure and human capital; strengthening institutional capabilities and economic openness; and promoting sound macroeconomic policies (low inflation, strong and sustainable economic growth). The purpose of this study is to extend the "Lucas paradox" approach (which considers only the economic fundamentals[7] and capital market imperfections), by integrating external factors from the traditional approach ("push-pull factors"). Emphasis will be given to physical infrastructure and financial development that have received insufficient attention in the literature (especially for financial development) given the importance of their contribution for countries attractiveness to private capital flows. We will analyze aggregated private capital flows and their components. Breaking-up aggregate private capital flows allows the differentiation between short-term and long-term flows, which can have some common determinants while other factors are specific to certain flows. Contrary to past studies, this paper, for the first time, takes into account the relationship between different components of private capital and non-linearity effects of physical infrastructure and financial development.

The rest of the paper is organised in two main sections: the first section analyzes the theoretical relation between private capital flows, physical infrastructure and financial development and describe a simple model based on the "Lucas paradox" approach. The second part of the study is devoted to the empirical analysis of the determinants of private capital flows followed by robustness checks. The last part concludes.

[7] The economic fundamentals include industrial capacity main determinants.

2. Physical Infrastructure and Private Capital Flows

A large number of studies (The World Bank, 1994; Temple 1999; Demurger, 2001; Willoughby, 2003) highlight the role of infrastructure (telecommunications, electricity, etc.) for economic growth and development. Beyond its direct effect on economic growth, infrastructure also affects growth by increasing private investment[8]. A greater availability of infrastructure increases the output of private investment by reducing transactions costs and enabling firms to get closer to their customers and suppliers, making it possible for the firms to increase their potential markets and thus their opportunities for profit. Well-developed telecommunications infrastructure, for example, can help firms to access financial resources through financial markets. Firms that do not have access to modern telecommunication services, reliable provision of electricity, or developed road systems invest less and have less productive investments (regardless of whether they are local or foreign). When the provision of well-functioning infrastructure fails, firms are sometimes forced to pay the costs of providing infrastructure themselves, such as electricity through power generating units, in order to continue their activities. This type of provision is generally more costly than traditional infrastructure provision. In addition to these high costs of provision, firms also support other costs due to damages caused by power outages.

The determinants of FDI may vary according to their type. FDI in manufacturing, services or in oil, gas and mineral extraction may have different determinants. Moreover, variables such as infrastructure, education or inflation may have different effects depending on the destination of FDI.

In previous studies, the importance of physical infrastructure in determining the attractiveness of foreign private capital essentially focused on FDI. Loree and Guisinger (1995) find that countries with developed infrastructure (measured by a multidimensional index of infrastructure) receive more FDI from United States. Wheeler and Mody (1992) and Mody and Srinivasan (1998) find similar results. Kumar (2002), with a sample of 66 countries over 1982-1994, finds that the development of

[8] See Blejer and Khan (1984), Greene and Villanueva (1991), Serven and Solimano (1993).

infrastructure, measured by a composite index, has a positive effect on FDI inflows. Ngowi (2001), Asiedu (2002) using a sample of African countries, and Jenkins and Thomas (2002), using a sample of Southern African countries, obtain similar results. The limited resources of public sector in developing countries, coupled with profitable opportunities in some infrastructure projects (electricity, telecommunications, etc.), lead to the provision of infrastructure by the private sector. Given the high cost of infrastructure investments, private corporations carrying out this type of investment are generally foreign. Sader (2000) finds that between 1990 and 1998, 17% of FDI flows received by developing countries were directed to infrastructure projects. According to Ramamurti and Doh (2004), FDI financing infrastructure represents one third of capital inflows to developing countries in the beginning of the 1990s.

3. Financial Development and Private Capital Flows

Financial development may increase private investments due to better access of firms to capital[9]. With the emergence of financial intermediaries, financial development reduces transactions costs through lower informational asymmetry and better risk management and coverage. The reduction of informational asymmetry through financial intermediaries has a considerable effect on foreign capital and investments. In fact, in addition to the informational asymmetry supported by the local entrepreneurs, the distance between foreign investors and local markets generally increases this already existing information asymmetry. Foreign investors know neither the opportunities nor the risks of the local market as well as local investors do. Financial intermediaries can provide information about local market risks, providing more credibility to potential profit in the country. This stimulates the entry of new investors, in particular foreign investors, in the local market. Huang (2006), focuses only on domestic investment, but suggests an empirical model for the importance of financial development on investment. Using a sample of 43 developing countries over 1970-1998, he finds that financial development significantly and positively affects private

[9] See Levine (1997, 2003) for a review of the theoretical and empirical literature.

investment. The author also concludes that private investment has a positive and significant effect on financial development. A developed financial sector also facilitates interactions between foreign and local firms and their suppliers and clients. The importance of financial intermediaries could also vary according to the type of private flows. Indeed, even if financial development significantly explains countries' attractiveness to FDI and debts, financial intermediaries' contribution for portfolio investments is more significant. Portfolio investments generally require the pre-existence of a stock market and thus a relatively developed financial sector. Financial development, itself, can imply the entry of new banks or new actors in the local market. The process of financial liberalization with bank privatization implies acquisitions in the form of FDI or portfolio investment, increasing of foreign private capital inflows. The importance of financial development for FDI could however be reduced with the entry of multinational banks which tend to follow their corporate clients.

As mentioned by Levine (1997), studies on financial development and investments generally do not distinguish domestic investments from foreign investments. Focusing only on foreign capital, this study enriches the scarce literature on this topic. To the best of our knowledge, very few studies deal specifically with the effect of financial development on private capital flows, precisely FDI. Hausmann and Fernandez-Arias (2000) find that countries with the least developed capital markets tend to have more FDI inflows. According to the authors, FDI can be alternative financing for the firms which do not have access to capital markets. However, using a sample of 81 foreign firms based in Southern African countries, Jenkins and Thomas (2002) show that South Africa attracts relatively more FDI than other African countries because of its developed financial system. Montiel (2006), in a theoretical analysis, argues that Africa does not attract enough foreign private capital to finance sectors with high potential profits because of Africa's human capital weakness, lack of infrastructure, and bad institutional quality. Montiel (2006) underlines that when African countries are relatively well endowed in these factors; financial underdevelopment explains their low attractiveness to foreign capital.

4. The Theoretical Model

The "Lucas paradox" is derived from a simple neoclassical growth model assuming a common technology to all economies. Let us consider a Cobb-Douglas production function with constant return to scales, representing a small open economy in which the production (Y) is obtained from the combination of capital (K) and labor (L).

$$Y_t = A_t F(K_t, L_t) = A_t K_t^{a} L_t^{1-a} \quad \text{with } F'(.)>0,\ F''(.)<0,\ F(0)=0 \qquad (1)$$

A is the productivity factor and reflects the technological level which can be stock of human capital (Lucas, 1990). Assuming a common technological level in all economies and perfect capital mobility, capital will flow from most endowed economies (in capital) to the least endowed countries because of the property of diminishing returns. That would lead to a convergence and equality of the interest rates. Considering two economies i and j, the interest rate r_t would be defined as follows:

$$At\, f'(k_{it}) = r_t = At\, f'(k_{jt}) \qquad (2)$$

However, the prediction of interest convergence is not observed, leading to the "Lucas paradox". According to Lucas, this paradox is mainly due to capital market imperfections (mostly informational asymmetry) and differences in economic fundamentals between countries, implying a difference of the technological factors (A_t). A could reflect for instance, available infrastructure, which is generally external to the firm. If i is a more developed country than j, then Lucas supposes that A_{it} is higher than A_{jt} which explains the fact that country i attracts more capital than the country j ($kit > kjt$) since the return of the capital is higher there. Giving-up the assumption of common technology between countries, the real return of capital becomes:

$$A_{it}\, f'(k_{it}) > A_{jt}\, f'(k_{jt}) \qquad (3)$$

With more detail, equation (3) can be rewritten as followed:

$$(A_{it} + I_{it}) f'(k_{it}) > (A_{jt} + I_{jt}) f'(k_{jt}) \qquad (4)$$

With I_{it} and I_{jt}, the infrastructure available in country *i* and *j* during the period t. A_{it} *and* A_{jt} represent other technological factors such as human capital, institutions, and macroeconomic conditions.

5. Empirical Analysis

5.1. Data and variables

The data cover the period 1970-2003 (subdivided into five periods of five years) and we retain for the regressions 58 developing countries.[10] The variables for private capital flows are FDI, portfolio investments, debts, and private capital -defined as an aggregate of the three types of private capital[11]. For the econometric analysis, we will only retain FDI and portfolio investments as variables of capital inflows for several reasons. After the debt crisis, data on debts suffer from significant measurement errors (Alfaro et al., 2006a, 2006b). The principal reason is the lack of data on debts existing exclusively between private agents (debt data used here are issued by private economic agents but can be contracted by private or public sector)[12]. These debts, contrary to the FDI and portfolio investments, reflect not only market incentives but also government's decisions; the objective of this chapter being to analyze market

[10] Central and Eastern European Countries (CEEC) are not taken into account in the regressions since the majority of these countries was created after 1990 whereas one of our objectives is to evaluate a differentiated effect before and after the 1990's financial crises.

[11] Foreign direct investment is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. Portfolio investment flows are net and include non-debt-creating portfolio equity flows (the sum of country funds, depository receipts, and direct purchases of shares by foreign investors). Bank and trade-related lending covers commercial bank lending and other private credits. (WDI 2005).

[12] We checked the specificity of debt compared to FDI and portfolio investments by adding to our system of two equations an equation of debt. The results (available upon request) show that physical and financial infrastructure does not increase debt inflows.

incentives. After the debt crisis for instance, the government of developing countries contracted a significant share of private debt.

Since 1970, developing countries have seen three episodes of massive surge in capital flows[13]. Beyond the evolution of private capital flows, their repartition is largely unequal, highlighting a marginalisation of Sub-Sahara African countries.

We use the proportion of the subscribers of fixed and mobile phone service in the population and the electric consumption per capita as the proxies for physical infrastructure. Although these variables approximate well the infrastructure available in a country, an addition excellent proxy for physical infrastructure would be the density of the road network in each country. Data missing problem do not allow the use of this last variable. Financial development is captured by three variables: the ratio of liquid liabilities to the GDP (M3/GDP), the ratio of bank credit to the private sector over the GDP, and the ratio of financial system deposits to the GDP. In accordance with the theoretical and empirical literature, we control for other important variables. Appendix 1 gives the list, definitions and sources of all variables.

5.2. Estimations

Although the objective of this chapter is not to test the existence of the "Lucas paradox," but rather its explanation, it is interesting to investigate whether this paradox, so far established between developed and developing countries can also be observed among developing countries. In other words, are countries with higher income level among developing countries receiving more private capital flows? The results, in appendix 5, show that among developing countries, private capital are more directed towards countries with higher GDP per capita, confirming the existence of "Lucas paradox" among developing countries.

[13] The general introduction (chapter 1) presents a comprehensive analysis of the trends, composition, and repartition of private capital flows to developing countries.

The analysis of the effects of physical infrastructure and financial development on private capital inflows is based on the following equation. It includes capital market imperfections and economic fundamental variables to explain the "Lucas paradox" and variables specific to capital exporters' countries in accordance with the "push-pull factors" approach:

$$Ci_{jt} = \lambda_j + \beta Inf_{jt} + \delta Fin_{jt} + \phi X_{jt} + \lambda_t + \varepsilon_{jt} \qquad (1)$$

Ci_{jt}, is a type i of private capital flow received by the country j in year t. Inf_{jt} is the variable of physical infrastructure and Fin_{jt} the variable of financial development. X_{jt} is the matrix of the control variables. The country and time fixed effects are respectively λ_j and λ_t while ε_{jt} is the error term. Because our sample is only made up of developing countries, the time fixed effects capture external factors ("push factors"). The growth rate or the interest rate of the developed countries, important variables in the determination of short-term capital flows (particularly portfolio investments), represent common shocks to all developing countries that are captured by the time fixed-effects. Capital market imperfections, which can be approximated by the distance between countries, reflecting informational asymmetry (Coval and Moskowitz, 1999, 2001), are taken into account in the country fixed effects.

The two equations of capital inflows could be estimated with standard fixed effect method. However this would suppose that the amount of the FDI received by a country is independent of the amount of portfolio investments received by this country (in other words, error terms of the two equations are not correlated). This rather restrictive assumption is not verified since a high number of identical variables explain the two components of capital flows. For instance, significant inflows of FDI in a country can stimulate the inflows of portfolio investments. It is thus important to consider the correlation of error terms that can affect the significance of the coefficients. The empirical model for estimation will be a system of equations as follows:

$$\begin{cases} FDI_{jt} = \lambda_j + \beta_1 Inf_{jt} + \delta_1 Fin_{jt} + \phi_1 X_{jt} + \lambda_t + \varepsilon_{jt} \\ PORT_{jt} = \lambda_j + \beta_2 Inf_{jt} + \delta_2 Fin_{jt} + \phi_2 X_{jt} + \lambda_t + \varepsilon_{jt} \end{cases} \qquad (2)$$

FDIjt and *PORTjt* represent net inflows of FDI and portfolio investments in country *j in* year *t,* respectively. The definition of the other explanatory variables remains identical to those given in equation 1. The use of Seemingly Unrelated Regression (SUR) would be more efficient than the standard fixed effect model (Arellano, 1987) since SUR takes into account the correlation between the errors terms. It is very likely that private capital flows received by a country affect its financial and physical infrastructure development. This potential reverse causality, as explained in the theoretical section, can be a source of endogeneity. In order to solve this problem, which is confirmed by the Nakamura-Nakamura test, we define three instruments: the lagged value of physical infrastructure variable, the lagged value of financial development variable, and the regulation of credit market as financial development variable instrument.[14] Instruments diagnostic with first-stage regressions statistics (partial R^2, Shea partial R^2, partial F-test, Cragg-Donald Statistics) reject the hypothesis of weak instruments (table 1).

Table 2.1 First-stage equation

	FDI		**Portfolio I.**	
Excluded Instruments	*Telephone*	*M3/GDP*	*Telephone*	*M3/GDP*
Telephone_1	2.010	-0.133	2.010	-0.136
	(26.81)***	(0.72)	(26.72)***	(0.73)
M3/GDP_1	-0.015	0.549	-0.015	0.548
	(0.60)	(9.12)***	(0.61)	(9.08)***
Regulation	-0.041	0.841	-0.041	0.839
	(0.21)	(1.76)*	(0.21)	(1.75)*
Weak instruments diagnostics				
Shea Partial R^2	0.83	0.33	0.83	0.33
Partial R^2	0.83	0.33	0.83	0.33
Partial F	268.19	27.72	266.41	27.49
p-values	*0.00*	*0.00*	*0.00*	*0.00*
Cragg-Donald F stat.	27.66		27.42	
Stock and Yogo Critical values				
10%	*13.43*		*13.43*	
15%	*8.18*		*8.18*	
20%	*6.40*		*6.40*	

* significant at 10%; ** significant at 5%; *** significant at 1%

[14] This variable of credit market regulation indicates governments' constraints or incentives in term of control of interest rates on deposits and bank loans. An instrument for financial development, commonly used in the literature is the legal origin. This instrument cannot be used in our case since it is already included in the country fixed effects.

For the estimations, we use three stage least squares (3SLS) which, like two stage least squares (2SLS), deals with the endogeneity problem but also takes into consideration the correlation between the errors terms of the equations like SUR method. Under the null assumption of good specification of all equations in the model, 3SLS is more efficient since it deals with the correlation of different equations' error terms. However, when at least one equation in the system is misspecified, this misspecification extends to all systems by the correlation of error terms, leading to biased and less consistent coefficients. In this case, the 2SLS estimator, although less efficient, is preferable since there is no correlation in error terms and it is consistent, even in the case of the misspecification of one equation in the system. Although results obtained by the 2SLS do not differ significantly (appendix 8), a Hausmann test confirms the preference for 3SLS.

5.3. Results

We first consider an index of physical and financial infrastructure obtained with principal components analysis that avoids colinearity problems between infrastructure variables. A second method of aggregation used is the standardisation of variables. This method is similar to principal component analysis but it gives an equivalent weight to each variable in the calculation of the index. The indexes include five variables: the proportion of subscribers of fixed and mobile phone, the electric consumption per capita, the ratio M3/GDP, the credit to private sector, and the deposits in financial institutions. The following table gives the results of estimations with aggregated indexes.

Table 2.2: Estimation with physical and financial infrastructure index

	Dependent Variables					
	Private capital	**FDI**	**Portfolio I.**	**Private capital**	**FDI**	**Portfolio I.**
Explanatory Variables	*2SLS*	*3SLS*	*3SLS*	*2SLS*	*3SLS*	*3SLS*
Infrastructure[1]	0.541 (2.56)**	0.331 (1.87)*	0.189 (2.04)**			
Infrastructure[2]				0.283 (2.88)***	0.205 (2.48)**	0.070 (1.62)
Control	-1.289 (2.38)**	-1.050 (2.31)**	-0.127 (0.53)	-1.222 (2.28)**	-0.982 (2.18)**	-0.128 (0.54)
Growth	0.193 (3.73)***	0.167 (3.93)***	0.056 (2.46)**	0.189 (3.84)***	0.171 (4.24)***	0.048 (2.23)**
Inflation	-0.000 (0.80)	-0.001 (2.18)**	0.000 (1.72)*	-0.001 (1.02)	-0.001 (2.29)**	0.000 (1.44)
Openness	-0.716 (0.69)	-0.390 (0.45)	-0.584 (1.28)	-0.695 (0.72)	-0.578 (0.71)	-0.395 (0.92)
Education	-0.004 (0.33)	-0.004 (0.36)	0.001 (0.21)	-0.002 (0.18)	-0.002 (0.22)	0.001 (0.28)
Property	-0.041 (0.41)	-0.061 (0.73)	0.010 (0.24)	-0.035 (0.36)	-0.063 (0.75)	0.017 (0.38)
Natural resources	-0.103 (0.71)	-0.084 (0.69)	0.013 (0.20)	-0.098 (0.68)	-0.079 (0.65)	0.013 (0.20)
Crisis	-0.708 (3.21)***		-0.152 (1.58)	-0.705 (3.25)***		-0.148 (1.57)
R^2	0.69	0.74	0.22	0.70	0.75	0.24
Sargan Stat.	0.01	0.28	0.53	0.02	0.06	0.49
(p-value)	*(0.95)*	*(0.40)*	*(0.53)*	*(0.89)*	*(0.19)*	*(0.52)*
Observations	197	197	197	197	197	197
Countries	45	45	45	45	45	45

z statistics in parentheses.
All regressions include time and country fixed effects.
* significant at 10%; ** significant at 5%; *** significant at 1%
1 Infrastructure index by principal component analysis
2 Infrastructure index by standardization

Before interpreting the results obtained with the infrastructure index, we separately estimate the equations with individual variables of infrastructure in order to address criticisms generally made to aggregate indicators that cannot distinguish the partial contribution of each variable. The following table gives the results of estimations considering a proxy for physical infrastructure (the proportion of fixed and mobile phone subscribers) and another one for financial development (M3/GDP) separately.

Table 2.3: Estimation (3SLS) with differentiation of physical and financial infrastructure

	Dependent Variables	
Explanatory Variables	**FDI**	**Portfolio I.**
Telephone	0.031	-0.006
	(2.53)**	(0.92)
M3/GDP	-0.016	0.017
	(1.06)	(2.10)**
Control	-1.080	-0.083
	(2.65)***	(0.40)
Growth	0.084	0.048
	(2.29)**	(2.52)**
Inflation	-0.002	0.000
	(3.73)***	(1.87)*
Openness	1.286	-0.532
	(1.65)*	(1.32)
Education	-0.003	0.001
	(0.34)	(0.22)
Property	-0.008	0.009
	(0.11)	(0.23)
Natural resources	-0.079	0.015
	(0.94)	(0.35)
Crisis		-0.128
		(1.55)
R^2	0.88	0.19
Sargan Stat.	0.14	0.29
(p-value)	*(0.29)*	*(0.41)*
Observations	239	239
Countries	58	58

z statistics in parentheses.
All regressions include time and country fixed effects.
* significant at 10%; ** significant at 5%; *** significant at 1%

Beside the instrument diagnostic tests which reject the hypothesis of weak instruments, the Sargan overidentification test does not reject the validity of the instruments. Control variables have almost identical effects when considering the index of infrastructure or individual variables of infrastructure and financial development. The macroeconomic instability, characterised by a high inflation or a banking crisis negatively affects FDI and portfolio investments respectively (table 2.2). Inflation positively affects portfolio investment. This result could illustrate the fact that Latin American countries, which attract an important part of portfolio investment in the sample, have higher inflation, particularly during the Mexican crisis of 1994. Capital controls[15] have a negative effect on private capital inflows and a good economic performance characterised by a high growth rate positively influences private flows. Countries that are more open also receive more FDI.[16]

Concerning the two variables of interest, the index of physical and financial infrastructure, either obtained by the principal components analysis or by the standardisation method, positively and significantly affects private capital flows and each of its components (FDI and portfolio investments). Physical and financial

[15] The measure of capital control is the average of proxies of government restrictions that affect capital mobility (capital account restrictions, current account restrictions, presence of multiple exchange rates and repatriation requirements for export proceeds). There is a structural break in capital account data series in 1996 when the IMF started to report more details on capital account -permitting a measure of the intensity of capital account restriction - instead of the dichotomous variable. That makes the data before and after 1996 not entirely comparable. Quinn (1997) and Mody and Murshid (2005) have constructed single data series using the IMF publications. Chinn (2004) finds also that Quinn index explain 71 percent of the four variables we used to construct our index before 1996. As Mody and Murshid (2005), a robustness check using a truncated sample (before 1996) does not change our results.

[16] Education does not affect significantly private capital flows to developing countries. According to the type of FDI (vertical FDI or horizontal FDI), multinational firms will look for unskilled cheap labor or skilled more expensive labor force. Urata and Kawai (2000) find that skilled labor availability discourages Japanese FDI. After a breakdown analysis, the authors show that skilled labor positively affects FDI in developed countries but the effect is not significant for developing countries.

infrastructure have a stronger impact on FDI than on portfolio investments, but this result gives no indication of the respective importance of physical or financial infrastructure in the attractivity of FDI or portfolio investments. Table 2.3 deals with this question by underlining the fact that physical infrastructure only affects FDI inflows while financial infrastructure only has a significant effect on portfolio investments. Indeed, a rise of 1 percentage point in the number of fixed and mobile phone subscribers increases FDI inflows by 0.03 percentage point. This result illustrates the existence of a minimal condition in order to guarantee prosperity of investments and thus attract FDI. A large number of economic activities (especially industrial ones) require a minimum of communication infrastructure (telephone, roads) allowing or facilitating the access to raw and intermediate materials but also the access to markets, reducing production costs. The government usually provides financing for infrastructure since firms can hardly support the cost. The existence of infrastructure thus creates a favourable business environment, encouraging investments, particularly foreign investments.

Portfolio investments are more volatile and relatively scarce in developing countries. Of the two infrastructure variables, only financial development significantly and positively affects portfolio investment flows to developing countries. A rise of 1 percentage point of liquidity liabilities increases portfolio investments by 0.02 percentage point. Inflows of portfolio investments require a high level of financial development since this form of capital flow is most frequently negotiated in stock markets. By improving information sharing, developed financial markets reduces transaction costs and the potential risk taken by investors.[17]

[17] The analysis shows that FDI and portfolio investments are mostly explained by identical determinants. It is important to pinpoint that some specific determinants of portfolio investments relate to the international economic situation, mainly the international interest rate and growth rate, approximated by those of the developed countries. As mentioned above, these important variables in the determination of portfolio investments are captured by time fixed-effects.

5.4. Robustness check and African specificity

5.4.1. Alternative explanatory variables

The literature suggests several variables that capture the physical infrastructure or financial development of a country. We considered the percentage of subscribers of fixed and mobile phone service in the population as a proxy for physical infrastructure and liquid liabilities (M3/GDP) as a proxy of financial development. The results can be influenced by the choice of these variables. As a robustness check, we estimate the system of equations with electric consumption per capita to reflect physical infrastructure and credit to private sector (in percentage of the GDP) as the financial development variable. The results are robust to the use of these alternative variables (table 2.4).

Table 2.4: Robustness checks (3SLS)

	Dependent Variables			
Explanatory Variables	**FDI**	**Portfolio I.**	**FDI**	**Portfolio I.**
Electricity	0.002 (3.86)***	-0.000 (1.60)		
Credit	0.098 (0.08)	1.644 (2.58)***		
Telephone			0.036 (2.80)***	-0.007 (0.98)
M3/GDP			-0.014 (0.93)	0.016 (2.04)**
Control	-1.027 (2.39)**	-0.259 (1.10)	-0.989 (2.38)**	-0.096 (0.45)
Growth	0.138 (3.45)***	0.062 (2.72)***	0.088 (2.38)**	0.048 (2.46)**
Inflation	-0.001 (3.20)***	0.000 (2.04)**	-0.002 (3.67)***	0.000 (1.85)*
Openness	-0.160 (0.20)	-0.546 (1.25)	1.169 (1.47)	-0.518 (1.26)
Education	0.002 (0.17)	-0.001 (0.10)	-0.004 (0.45)	0.001 (0.25)
Property	-0.052 (0.66)	0.028 (0.64)	-0.014 (0.18)	0.010 (0.25)
Natural resource	-0.093 (0.80)	0.019 (0.30)	-0.083 (1.00)	0.016 (0.36)
Crisis		-0.121 (1.28)		-0.127 (1.54)
Change			-0.336 (1.09)	0.048 (0.30)
R^2	0.77	0.23	0.88	0.19
Sargan Stat.	5.40	6.02	0.24	0.33
(p-value)	*0.98*	*0.98*	*0.37*	*0.44*
Observations	197	197	239	239
Countries	45	45	58	58

z statistics in parentheses.
All regressions include time and country fixed effects.
* significant at 10%; ** significant at 5%; *** significant at 1%

Since portfolio investments are short-term flows, high variability in exchange rates could cause uncertainty in the return on these investments. Exchange rate variability may also negatively affect long-term flows such as FDI by increasing uncertainty in returns. Considering the exchange rate variability variable, the main results remain robust (table 2.4).

5.4.2. Non-linear relationship

Up to this point, we have only tested linear relations whereas the physical infrastructure may have a congestion effect. Even if the number of subscribers to telephone service or electric consumption per capita has a positive effect on capital inflows, it would be possible that this positive effect vanishes above a certain level of telephone subscribers. For a given level of income, excessive number of telephone subscribers could illustrate high telecommunication cost that forces subscribers to hold one mobile phone for each of the main mobile companies operating in the country. This phenomenon could be observed in African countries such as Côte d'Ivoire or Nigeria. The interaction between infrastructure and other limited factors such as the stock of human capital could also explain the congestion effect. An increase in credit or liquid liabilities can be a signal of a financial development but an excessive supply of money or private credit could also indicate a bad management of the monetary policy or be the precursory sign of a financial crisis. Table 2.5 shows the results considering possible thresholds for the impact of infrastructure and financial development[18].

[18] The Ramsey-Reset test confirms the non-linearity suspected for the variables of physical and financial infrastructure.

Table 2.5: Non linearity check (3SLS)

	Dependent Variables	
Explanatory Variables	**FDI**	**Portfolio I.**
Telephone	0.099	0.029
	(2.04)**	(1.08)
M3/GDP	0.054	0.069
	(1.31)	(3.04)***
Telephone^2	-0.001	-0.000
	(1.34)	(1.07)
M3/GDP^2	-0.001	-0.001
	(2.03)**	(3.48)***
Control	-0.641	0.203
	(1.38)	(0.79)
Growth	0.078	0.027
	(2.38)**	(1.47)
Inflation	-0.001	0.001
	(1.98)**	(2.56)**
Openness	1.116	-0.084
	(1.57)	(0.22)
Education	-0.001	0.002
	(0.12)	(0.51)
Property	-0.006	0.023
	(0.08)	(0.59)
Natural resources	-0.065	0.026
	(0.79)	(0.60)
Crisis		-0.024
		(0.28)
R^2	0.89	0.15
Sargan Stat.	0.41	4.85
(p-value)	*(0.48)*	*(0.97)*
Observations	239	239
Countries	58	58

z statistics in parentheses.
All regressions include time and country fixed effects.
* significant at 10%; ** significant at 5%; *** significant at 1%
Telephone^2 and M3/GDP^2 are the squared values of Telephone and M3/GDP

The main results are confirmed and the effects of physical and financial infrastructure on FDI and portfolio investment inflows become higher. Once we have allowed for non-linearity, the results show significant a threshold effect for financial development. This highlights the importance of good management of the monetary policy and the negative impact of excessive money supply.

5.4.3. Structural Break and African Specificity

Private capital inflows, particularly FDI to developing countries, have risen exponentially since 1990 with a peak prior to the Asian crisis (chapter 1). Important reforms in the liberalization of current and capital accounts were undertaken by developing countries at the beginning of the 1990s within the framework of the Washington Consensus in order to attract more private capital. A temporal Chow test before and after 1990 enables us to show stability of the coefficients during the two periods. There is no differentiated effect on the determinants of private capital due to the reforms, and no specificity before and after the 1990s crises.[19] The analysis of private capital inflows to developing countries also shows a marginalisation of Sub-Saharan African countries (chapter 1). Analysis of the Sub-Saharan African sample shows an African specificity which is confirmed by the Chow test. Considering only Sub-Saharan African (SSA) countries, the results show that physical infrastructure positively and significantly affects FDI inflows.[20]

[19] Data availability does not allow the test of other dates of potential ruptures or an Andrews-Quandt test that would enable to determine the break point. The choice of the break period, although imposed to us by the data is also justified theoretically

[20] Given the low level of portfolio investment in Sub-Saharan African countries and the fact that South Africa is the main destination of these portfolio investments, we consider only FDI for the estimation on SSA countries. The specificity of SSA countries is confirmed with the introduction of a dummy in the full sample. The results obtained for the SSA countries sample are similar after a standardization of the coefficients.

Table 2.6: Sub-Saharan Africa specificity (3SLS)

	Dependent Variables						
	Total Sample		**Restricted Sample[1]**		**Restricted Sample[1]**		**SSA[2]**
	FDI	**Portfolio I.**	**FDI**	**Portfolio I.**	**FDI**	**Portfolio I.**	**FDI**
Telephone	0.031	-0.006	0.030	-0.009	0.099	0.029	0.043
	(2.53)**	(0.92)	(2.36)**	(1.44)	(1.97)**	(1.14)	(2.31)**
M3/GDP	-0.016	0.017	-0.016	0.023	0.053	0.084	-0.030
	(1.06)	(2.10)**	(1.00)	(3.03)***	(1.30)	(3.92)***	(1.35)
Control	-1.080	-0.083	-1.052	-0.097	-0.605	0.239	0.437
	(2.65)***	(0.40)	(2.50)**	(0.49)	(1.26)	(0.97)	(0.74)
Growth	0.084	0.048	0.087	0.057	0.081	0.033	0.078
	(2.29)**	(2.52)**	(2.31)**	(3.13)***	(2.40)**	(1.85)*	(2.20)**
Inflation	-0.002	0.000	-0.002	0.000	-0.001	0.001	0.007
	(3.73)***	(1.87)*	(3.60)***	(2.13)**	(1.93)*	(2.99)***	(1.04)
Openness	1.286	-0.532	1.220	-0.650	1.061	-0.130	2.203
	(1.65)*	(1.32)	(1.52)	(1.71)*	(1.46)	(0.35)	(3.31)***
Education	-0.003	0.001	-0.003	-0.002	-0.001	-0.000	0.013
	(0.34)	(0.22)	(0.33)	(0.45)	(0.09)	(0.01)	(1.62)
Property	-0.008	0.009	-0.009	-0.011	-0.002	0.008	0.188
	(0.11)	(0.23)	(0.11)	(0.30)	(0.02)	(0.20)	(1.93)*
Natural resources	-0.079	0.015	-0.078	0.023	-0.065	0.034	0.046
	(0.94)	(0.35)	(0.91)	(0.56)	(0.77)	(0.81)	(0.68)
Crisis		-0.128		-0.086		0.042	
		(1.55)		(1.09)		(0.49)	
Telephone^2					-0.001	-0.000	
					(1.30)	(1.17)	
M3/GDP^2					-0.001	-0.001	
					(2.02)**	(4.30)***	
R^2	0.88	0.19	0.88	0.10	0.89	0.10	0.89
Sargan Stat.	0.14	029	0.09	0.34	0.50	6.03	1.24
(p-value)	*(0.29)*	*(0.41)*	*(0.24)*	*(0.44)*	*(0.52)*	*(0.98)*	*(0.74)*
Observations	239	239	226	226	226	226	70
Countries	58	58	55	55	55	55	22

z statistics in parentheses.
All regressions include times and country fixed effects.
* significant at 10%; ** significant at 5%; *** significant at 1%
Telephone^2 and M3/GDP^2 are the squared values of Telephone and M3/GDP
[1] Restricted sample is the total sample without some major developing countries: Brazil, India and South Africa
[2] SSA indicates Sub-Saharan African countries

A rise of 1 percentage points in the number of subscribers to fixed and mobile phone service increases FDI inflows to SSA countries by 0.04 percentage points. These results may be explained by the fact that most SSA countries have a relatively low level of infrastructure development. On average, over the period 1970-2003, only 2 percent of the population in SSA countries were telephone subscribers compared to 5 percent for Asian countries and 12 percent for Latin America countries. A simple simulation shows that if SSA countries were to reach the same level of physical infrastructure development as Asian countries, FDI inflows would increase by 6.5 percentage points. This simulation reveals the importance of physical infrastructure in attracting FDI for SSA countries attractiveness. The estimation for the sub-sample of SSA countries also highlights the importance of trade openness, economic growth and property rights protection in increasing attractiveness for FDI. It is also important to note that the results are robust to potential influential countries (Brazil, India and South Africa) since these countries attract an important part of FDI and portfolio investments received by developing countries.

6. Conclusion

This chapter has analyzed the determinants of private capital flows in developing countries, with particular attention to physical infrastructure and financial development. Based on two theoretical approaches (Lucas paradox and push-pull factors) and after controlling for interaction between components of capital flows (with 3SLS), this study finds that physical infrastructure only fosters FDI inflows while financial development has a positive effect on portfolio investments. The results highlight the importance of non-linearity -particularly for financial development- in analyzing the determinants of foreign private capital. This indicates the importance of sound monetary policy and stronger oversight in the financial system. Indeed, lax monetary policy and excessive credit provision could weaken the financial system and significantly reduce portfolio investment inflows. It is thus important that policies aiming to attract more private capital consider also the possible negative effects such as sudden stops or reversal of short-term capital flows by maintaining an adequate

monetary policy and improving the supervision and the regulation of the financial system.

A study of African specificity underlines the important role of physical infrastructure in attracting FDI inflows. Development of infrastructure should attract more private investments, in particular from abroad. Programs such as the NEPAD (New Partnership for Africa's Development) in Africa aim to find more funds for infrastructure. This study encourages this type of initiative for a continent which should benefit considerably from the development of its infrastructure by attracting private capital, in particular FDI. Beyond their effects on private capital flows, the development of infrastructure also promotes economic growth by increasing the productivity of the economy.

To give more credit to these findings, the next chapter will analyze deeply the determinants of FDI using disaggregated firm-level data in the manufacturing sector.

Appendices

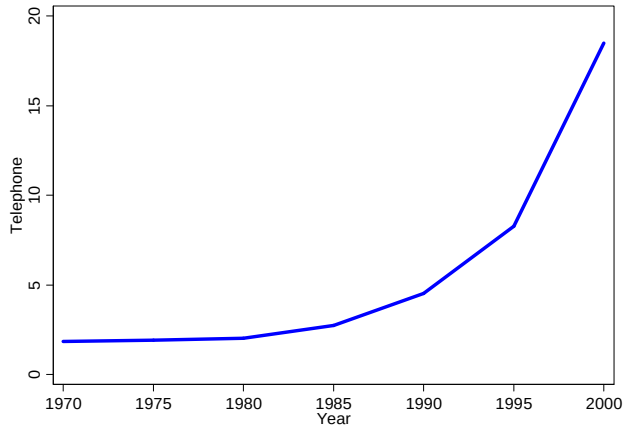
Appendix 2.1: List of variables

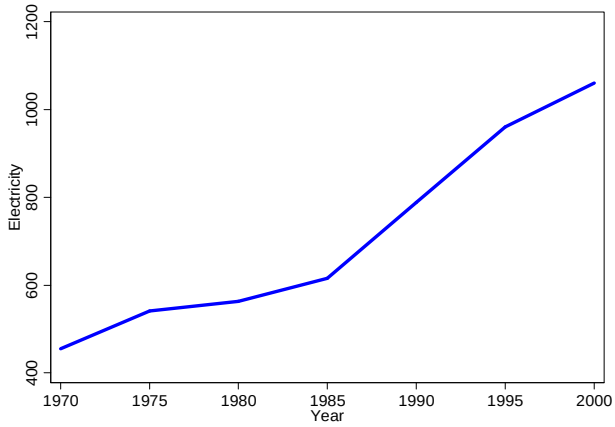
Variables	Definitions	Sources
FDI	Foreign direct investment, net inflows (% of GDP)	Global Development Finance (2005)
PORTFOLIO I.	Portfolio investment, equity (% of GDP)	
DEBT	Bank and trade-related lending (% of GDP)	
M3/GDP	Liquid liabilities (M3) as % of GDP	Financial Structure Dataset (2006)
Credit	Domestic credit provided by banking sector (% of GDP)	
Deposit	Financial System Deposits (% of GDP)	
Telephone	Fixed line and mobile phone subscribers per 100 inhabitants	World Development Indicators (2005)
Electricity	Electric consumption per capita	
Growth	Economic growth rate	
Inflation	Inflation rate	
Openness	Sum of exports and imports of goods and services as a share of gross domestic product	
Change	Exchange rate variability (standard deviation)	
Control	Capital control indicator : average of four dummies: Exchange arrangements, payments restrictions on current transactions and on capital transactions, and repatriation requirements for export proceeds	Milesi Ferretti (1970-1997) and Annual Report on Exchange Arrangement and Exchange Restrictions (1998-2003)
Crisis	Financial crisis dummy	Caprio and Klingebel (2003)
Education	Gross primary enrollment rate	UNESCO Statistics (2004)
Natural resources	Log of oil, gas, metal and mineral rents	World Bank (2002)
Regulation	Credit market regulation	Fraser Institue (2005)
Property	Property right Protection	

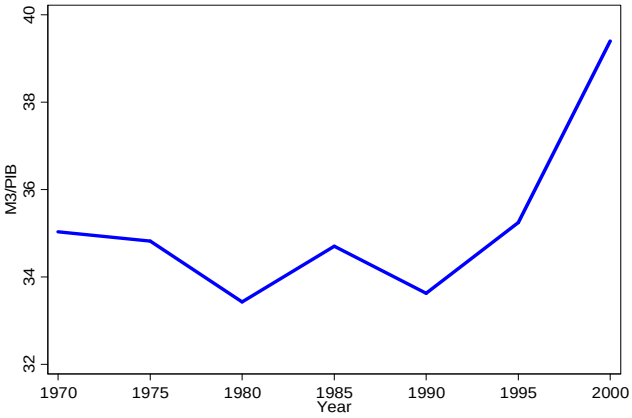
Appendix 2.2: Descriptive Statistics

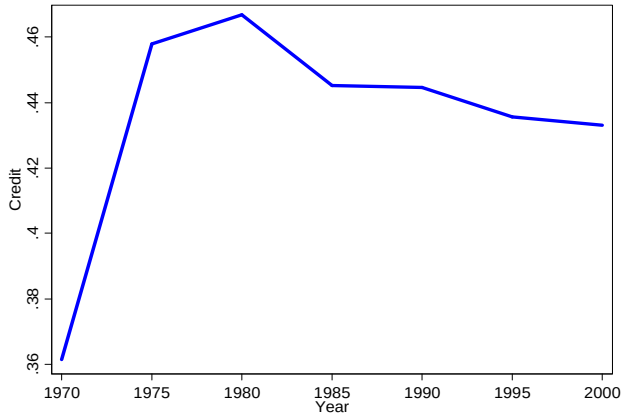
Variable	Observation	Mean	Standard D.	Min	Max
Private capital	239	1.90	2.77	-3.32	31.72
FDI	239	1.79	2.67	-3.32	31.72
Portfolio I.	239	0.11	0.52	-0.78	5.82
Telephone	239	7.80	11.94	0.06	75.46
Electricity	197	813.87	839.78	26.20	3961.69
M3/GDP	239	36.42	21.39	9.86	124.90
Credit	235	0.46	0.29	0.06	1.57
Deposit	239	29.71	19.84	0.05	116.38
Growth	239	1.13	2.81	-7.89	8.24
Inflation	239	34.13	189.34	-18.78	2414.35
Openness	239	0.62	0.30	0.13	2.16
Control	239	0.61	0.27	0.00	1.00
Education	239	95.49	20.70	25.00	148.67
Property	239	4.46	1.30	1.58	7.06
Natural resources	239	18.99	3.96	7.73	24.33
Crisis	239	0.42	0.49	0.00	1.00
Regulation	239	5.94	2.15	0.00	9.85

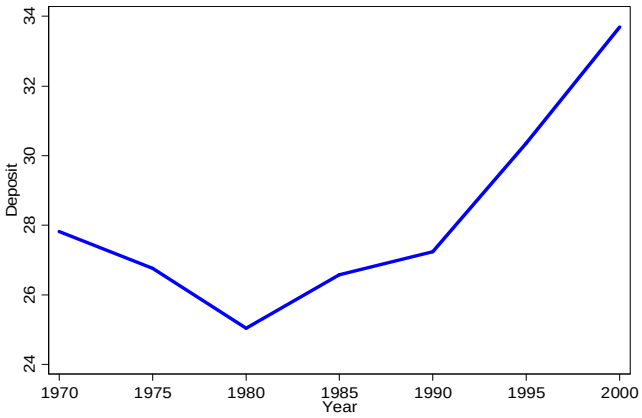
Appendix 2.3: Evolution of variables

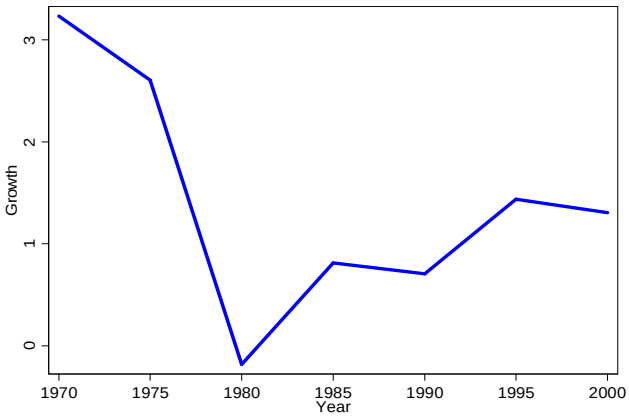


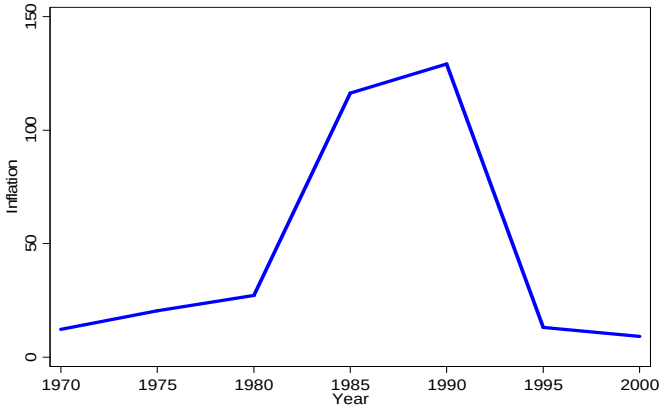


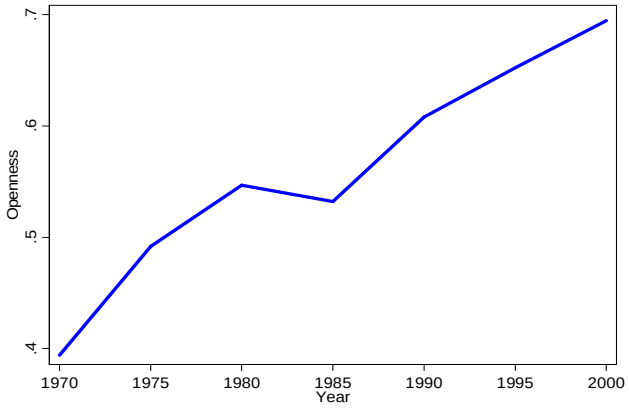


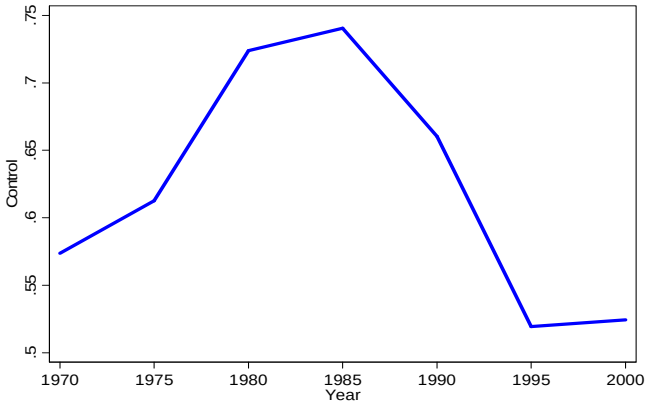


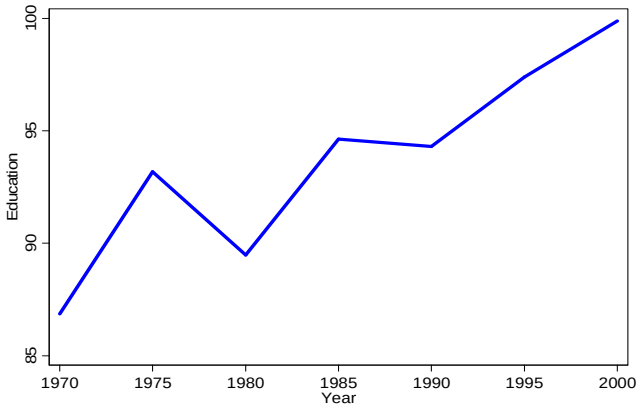


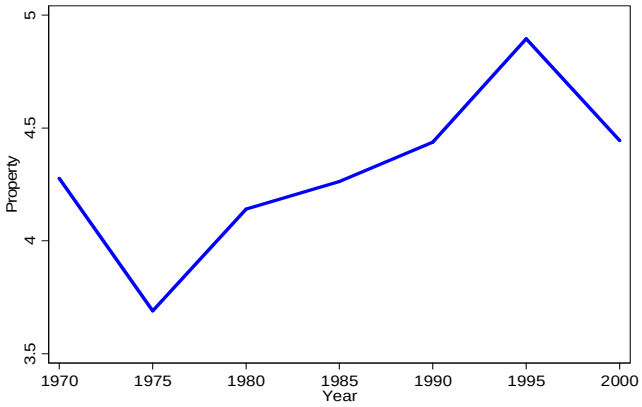


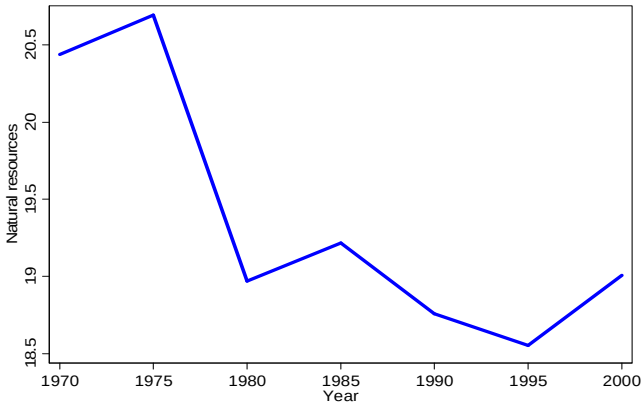

Inflation
0
50
100
150
1970
1975
1980
1985
1990
1995
2000
Year

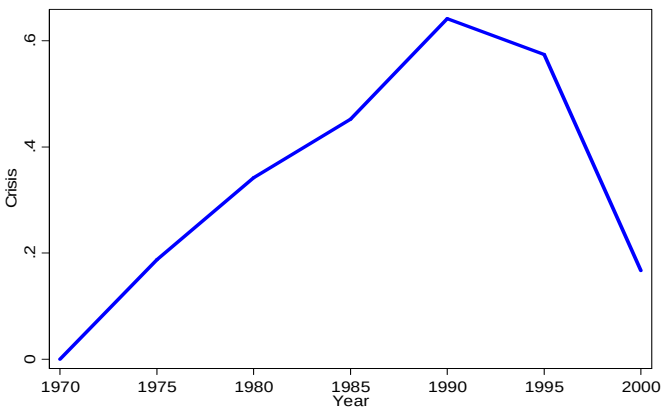

Openness
.4
.5
.6
.7
1970
1975
1980
1985
1990
1995
2000
Year

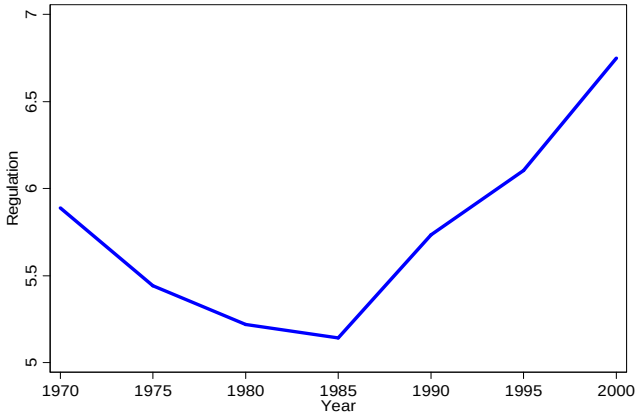

Control
.5
.55
.6
.65
.7
.75
1970
1975
1980
1985
1990
1995
2000
Year


Education
85
90
95
100
1970
1975
1980
1985
1990
1995
2000
Year


Property
3.5
4
4.5
5
1970
1975
1980
1985
1990
1995
2000
Year


Natural resources
18.5
19
19.5
20
20.5
1970
1975
1980
1985
1990
1995
2000
Year


Crisis
0
.2
.4
.6
1970
1975
1980
1985
1990
1995
2000
Year


Regulation
5
5.5
6
6.5
7
1970
1975
1980
1985
1990
1995
2000
Year

Appendix 2.4: Illustration of Lucas paradox among developing countries

	Dependent Variable: Private Capital per capita	
Explanatory Variables	*Fixed Effect*	*2SLS*
GDP per capita	0.065	0.061
	(11.68)***	(6.43)***
Constant	-5.301	-15.896
	(0.46)	(0.78)
Observations	668	571
Countries	106	106
R²	0.25	0.29

t statistics in parentheses
All regressions include time and country fixed effects.
significant at 10%; ** significant at 5%; *** significant at 1%
The regression is based on a large sample of developing countries including the countries retained for the rest of the analysis.

Appendix 2.5: Correlation between the main variables

	FDI	**Portfolio I.**	**Telephone**	**Electricity**	**M3/GDP**	**Credit**	**Deposit**
FDI	1						
Portfolio I.	0.0812	1					
Telephone	0.2401*	0.0587	1				
Electricity	0.3146*	0.2042*	0.6613*	1			
M3/GDP	0.1080*	0.1006*	0.3543*	0.2998*	1		
Credit	-0.0276	0.2246*	0.2933*	0.4181*	0.7031*	1	
Deposit	0.1849*	0.1408*	0.4365*	0.4170*	0.9506*	0.7109*	1

* significant at 1%

Appendix 2.6: Eigenvalue and variance with principal components analysis

Principal components	Eigenvalue	Proportion of variance	Cumulative Variance
1	3.07	0.61	0.61
2	1.19	0.24	0.85
3	0.42	0.09	0.94
4	0.27	0.05	0.99
5	0.05	0.01	1.00

	Eigenvectors				
Variable	**1**	**2**	**3**	**4**	**5**
M3/GDP	0.50	-0.36	-0.31	-0.23	0.69
Deposit	0.53	-0.25	-0.26	-0.28	-0.72
Credit	0.47	-0.26	0.60	0.59	-0.01
Telephone	0.34	0.63	-0.49	0.50	0.02
Electricity	0.37	0.59	0.49	-0.52	0.09

Appendix 2.7: 2SLS Estimation with physical and financial infrastructure index

	Dependent Variables					
Explanatory Variables	**Private capital**	**FDI**	**Portfolio I.**	**Private capital**	**FDI**	**Portfolio I.**
Infrastructure[1]	0.541	0.327	0.191			
	(2.56)**	(1.84)*	(2.05)**			
Infrastructure[2]				0.283	0.207	0.071
				(2.88)***	(2.50)**	(1.63)
Control	-1.289	-1.051	-0.136	-1.222	-0.980	-0.137
	(2.38)**	(2.31)**	(0.57)	(2.28)**	(2.18)**	(0.58)
Growth	0.193	0.166	0.054	0.189	0.171	0.046
	(3.73)***	(3.92)***	(2.35)**	(3.84)***	(4.25)***	(2.12)**
Inflation	-0.000	-0.001	0.000	-0.001	-0.001	0.000
	(0.80)	(2.20)**	(1.76)*	(1.02)	(2.28)**	(1.48)
Openness	-0.716	-0.377	-0.564	-0.695	-0.590	-0.373
	(0.69)	(0.43)	(1.24)	(0.72)	(0.73)	(0.87)
Education	-0.004	-0.004	0.001	-0.002	-0.002	0.001
	(0.33)	(0.36)	(0.18)	(0.18)	(0.22)	(0.26)
Property	-0.041	-0.061	0.011	-0.035	-0.063	0.017
	(0.41)	(0.72)	(0.25)	(0.36)	(0.76)	(0.40)
Natural resources	-0.103	-0.084	0.010	-0.098	-0.078	0.010
	(0.71)	(0.69)	(0.16)	(0.68)	(0.65)	(0.16)
Crisis	-0.708		-0.195	-0.705		-0.192
	(3.21)***		(2.01)**	(3.25)***		(2.01)**
R^2	0.84	0.86	0.25	0.84	0.87	0.27
Sargan Stat.	0.01	0.27	0.33	0.02	0.06	0.28
(p-value)	*0.95*	*0.60*	*0.57*	*0.89*	*0.80*	*0.59*
Observations	197	197	197	197	197	197
Countries	45	45	45	45	45	45

z statistics in parentheses.
All regressions include time and country fixed effects.
* significant at 10%; ** significant at 5%; *** significant at 1%
1 Infrastructure index by principal component analysis
2 Infrastructure index by standardization.

Appendix 2.8: Sample for estimation

Sub-Saharan Africa	Latin America and Caribbean	Asia
Benin	Argentina	Algeria*
Botswana	Barbados	Bangladesh
Burundi	Bolivia	Egypt*
Cameroon	Brazil	India
Central African Republic	Chile	Indonesia
Chad	Colombia	Iran
Congo, Rep.	Costa Rica	Jordan
Cote d'Ivoire	Dominican Republic	Malaysia
Ghana	Ecuador	Oman
Kenya	El Salvador	Pakistan
Madagascar	Guatemala	Papua New Guinea
Niger	Honduras	Philippines
Nigeria	Jamaica	Sri Lanka
Rwanda	Mexico	Syrian Arab Republic
Senegal	Nicaragua	Thailand
Sierra Leone	Peru	Turkey
South Africa	Trinidad and Tobago	Tunisia*
Tanzania	Venezuela	Vietnam
Togo		
Uganda		
Zambia		
Zimbabwe		

*Three North African countries are considered in the group of Asian countries because of their similarity to Middle East countries more than to Sub-Sahara African countries.

Chapter 3:
Investment Climate and FDI in Developing Countries: Firm-Level Evidence

1. Introduction

A complete and often-used conceptualization of FDI determinants is the Eclectic paradigm (Dunning, 1980, 1993). This paradigm provides a framework that groups micro and macro level determinants in order to analyze why and where Multinational Enterprises (MNEs) invest abroad. This framework is based on *Ownership*, *Location* and *Internalization* advantages, known as OLI. This chapter focuses on the second aspect of the OLI framework according to which MNEs invest in a foreign country in order to get advantages based on location (lower factor cost, lower trade cost, etc.). According to the OLI framework, firms invest abroad to look for three types of location advantages. The first one is to exploit and export natural resources and resource-based products. The motivation of these resource-based investments is mainly the availability of resources. The second reason is to supply the domestic market of the recipient country through an affiliate: *Horizontal FDI (HFDI)*. In this case of market-oriented investment, gains in trade costs and strategic advantages (intangible assets) should be important compared to the cost of setting up a new plant. The third reason of FDI is to delocalize all or a portion of the production process (production of components, and increasingly service activities such as call centers) in order to benefit from low costs: *Vertical FDI (VFDI)*. This kind of FDI often occurs when firms can break down their production process into different parts and different locations according to factor costs in these locations. The determinants of vertical and horizontal FDI thus differ, and the effects of identical variables could also be different according to the type of FDI. A typical example is that trade costs increase HFDI but reduce VFDI. Since it is very difficult to divide data into VFDI and HFDI, most studies use the aggregate FDI. Our study follows this pattern firstly and then distinguishes the two types of FDI.

The analysis of the determinants of FDI can be done using a macroeconomic approach that assesses how country level determinants affect foreign capital (chapter 2). The analysis can also be based on firm-level data or provides a more complete picture that interacts firm and country characteristics. In complement to chapter 2, based on country-level data, this chapter uses firm-level data, while controlling for some

country-level factors. The following literature review is therefore mainly based on studies using disaggregated data and firms' strategic considerations.

The analysis of the determinants of FDI already received much attention in the literature. Intangible assets, measured by *advertising* or *Research and Development (R&D)* intensities can affect firms' decision to invest abroad. Brainard (1997) finds that advertising intensity positively affects affiliate sales. *Market size* is an important determinant of MNEs location, particularly in the case of Horizontal FDI (Carr et al., 2001; Markusen and Maskus, 2002). Urata and Kawai (2000) show a positive role of market size in attracting Japanese Small and Medium Entreprises (SMEs). They also conclude that the importance of market size is more significant for developed countries compared to developing countries. Disdier and Mayer (2004) find that market size, approximated by the GDP, positively and significantly affects the location of French MNEs in 19 Eastern and Western European countries between 1980 and 1999.

Factor cost differences also affect the location of foreign investment. A number of studies have tested whether lower wages determine FDI in developing countries. Urata and Kawai (2000) find that lower wages positively and significantly affect the probability of SMEs location in general; but this result is not significant for developed countries[21]. Disdier and Mayer (2004) find that low wages increase the probability of French MNEs to set-up new plants in Eastern and Western Europe. *Trade costs*, including transport costs and trade barriers (tariffs and non-tariffs) are also important factors explaining FDI. According to the type of FDI (vertical or horizontal), trade costs can increase or discourage FDI. Carr et al. (2001) and Yeaple (2003) find that FDI (measured by foreign subsidiaries sales) increases with higher trade costs in the case of horizontal FDI. However, Hanson et al. (2001) show that trade cost discourages vertical FDI by increasing the global production cost.

[21] As predicted by some theories, MNEs are attracted by lower wages in developing countries, but not in developed countries.

There is no clear-cut evidence on the effect of taxes on FDI but many countries try to promote FDI by providing generous *tax incentives* to MNEs. A number of recent studies (particularly in developed countries) conclude that tax incentives affect the location of MNEs but not their decision to invest (Devereux and Griffith 1998, 2002). De Mooij and Ederveen (2003), in their literature survey based on 25 studies, find a median of the elasticity of FDI to tax of -3.3. However, the impact of taxes on FDI varies according to the taxation system (tax type, double taxation issue, etc.). In the particular case of developing countries, tax incentives or subsidies cannot compensate for structural problems of infrastructure, institutions, and market access. Studies also point-out additional factors explaining the FDI such as *exchange rate*, *inflation*, *unemployment rate*, and *agglomeration effect* (Bloningen, 1997; Urata and Kawai, 2000; Disdier and Mayer, 2004).

Most of the studies on FDI location using micro-level data focus on variables such as R&D, factor cost differences, advertising expenditures, wages, trade costs, market size or taxation. These predictors are intuitive, as these studies have focused on developed countries (except China). For instance, the availability of cheap labor or a large local market could be important factors attracting foreign investment. However, these factors are not necessarily the most important ones in developing countries given the presence of deficient infrastructure, high financing constraints, weak institutions, or lack of skilled labor.

Good institutions play a crucial role in attracting FDI to developing countries. The probability that foreign investors get return on their investments is fundamental in their decision to invest in a country or not. Secure property rights, political stability, and lack of corruption allow markets to function properly, therefore attracting MNEs. Using a composite measure of risk factors including institutional variables such as corruption, political instability, and the quality of the legal system, Wheeler and Mody (1992) find that institutions do not affect the location of US MNEs in 42 developed and developing countries. Based on the analysis of Japanese SMEs, Urata and Kawai (2000) find that better institutions (measured by the weighted average of five

indicators[22]) increase the probability for a developing country to host a Japanese FDI but the result is not significant for developed countries. Disdier and Mayer (2004) also find that the quality of institutions positively affects the location of French multinational in Western and Eastern Europe. Based on the inclusive value of their nested logit regression, they show that institutional quality is a key variable explaining the difference between Eastern and Western Europe for the location of French MNEs. Using the data of 6288 affiliates of U.S. MNEs located in the different regions of China from 1993 to 2001, Du et al. (2007) show that regions with better institutions (protection of property rights, contract enforcement, lower government intervention in business, and low corruption) attract more affiliates. Other authors find similar conclusion (Wei, 2000; Daude and Stein, 2007).

It is generally believed that the availability of skilled workers positively affects developing countries' attractiveness to foreign capital. In reality, depending on the form of FDI (Vertical FDI or Horizontal FDI), MNEs look for unskilled cheap labor, or skilled, more expensive labor force[23]. Yeaple (2003) finds that U.S. MNEs that invest in skilled labor-abundant countries are skill-intensive industries while countries with a low-skilled labor force receive more non-skilled intensive MNEs. Urata and Kawai (2000) find that the availability of skilled labor force does not attract Japanese FDI. A breakdown analysis by development level shows that the availability of skilled labor positively affects FDI in developed countries but the effect is not significant for developing countries. These results suggest that Japanese SMEs that invest in developing countries look for low-skilled, low-wage labor force but those investing in developed countries use high-skilled labor force. Fung et al. (2002) analyze FDI from the United States, Japan, and the group of other investing countries in China over the period 1991-1997. They find that the quality of labor in Chinese provinces, expressed as the share of higher education students in the total population, positively and

[22] The five indicators are government repudiation of contracts, risk of expropriation, corruption, law and order tradition, and the bureaucratic quality.

[23] The host country skilled labor can be cheaper than skilled labor in the home countries. This is the case for most of the call centres which look for relatively cheap skilled labor force.

significantly affects FDI from the U.S and Japan. Using four measures of labor quality (derived from educational attainment) over the period 1996-1999, Gao (2005) finds that the quality of labor force does not affect aggregated (for all source countries) FDI in Chinese provinces. However, labor quality positively and significantly affects FDI in Chinese provinces with bilateral data.

Most studies of FDI determinants that use firm-level data in developing countries have focused on China. This chapter introduces firm-level data for a large sample of developing countries in order to assess the determinants of FDI with a focus on infrastructure, institution and human capital. By contrast with other studies (except studies on US affiliates), this chapter considers foreign affiliates located in developing countries. The main results show that physical infrastructure problems, financing constraints, and institutional problems discourage FDI to developing countries, and particularly to Sub-Saharan African countries.

The remainder of the chapter is structured as follows: the first part reviews the theoretical relationship between physical infrastructure, financial development and FDI. The second part presents descriptive and statistical analyses. The third part is devoted to econometric analyses and results. The last part concludes.

2. Physical Infrastructure and FDI

Infrastructure availability is one of the key elements needed to run efficient business. Well-developed infrastructure is essential to attract foreign capital and promote economic growth. In the manufacturing or service sector, a good provision of infrastructure reduces transaction costs by allowing entrepreneurs to connect easily with their suppliers and customers. By improving market access and thus increasing the real size of the available market, good infrastructure is particularly important for foreign firms, attracted in general by large markets. A large number of studies in developing countries have shown the importance of infrastructure for FDI using aggregated country-level data (Asiedu, 2002; Ngowi, 2001, Wheeler and Mody, 1992). Most of the studies that use disaggregated data to explore how infrastructure affects FDI in developing countries have focused on China and its provinces. Cheng and

Kwan (2000) use panel data from 1985 to 1995 and show that good infrastructure positively and significantly affects FDI location in 29 Chinese regions. Hongxin and Gangti (2000) use FDI location in 50 areas of China to underline the importance of infrastructure as a determinant of FDI. They define a composite measure of infrastructure using the average road per km², the number of post offices per capita, and the number of telephone lines per capita. Sun et al. (2002) find a similar result for 30 Chinese provinces over the period 1986-1998. With aggregated and firm-level data on Korean and Japanese foreign affiliates located in China, Kang and Lee (2004) find that infrastructure (measured as the kilometers of railways per km²) encourages Korean FDI in China, but not Japanese FDI. Based on 120 cities and 12,400 firms in China, a World Bank (2006) report indicates that infrastructure constraints (measured by port costs) negatively and significantly affect FDI.

A small number of studies include developing countries other than China. The importance of infrastructure such as a reliable provision of electricity is probably more crucial for small and medium firms. In fact, large firms could be able to finance their own power-generating units. Using the level of electricity generation per capita as a proxy for infrastructure, Urata and Kawai (2000) find that infrastructure is an important determinant of the location of Japanese SMEs. They also highlight the higher importance of infrastructure for developing countries compared to developed countries. According to the authors, good provision of infrastructure is particularly relevant for SMEs working in sectors such as textile, general machinery and electric machinery. Based on a sample of 293 foreign firms in Turkey during 1995, Deichmann et al. (2003) approximate infrastructure development by the share of paved roads in each region and find that good infrastructure increases the probability to receive a foreign firm. Although firms in service sectors use dominantly intangible products that do not necessary need roads for transportation, the availability of paved roads in a region is positively and significantly associated with the location of affiliates in the sector of services in Turkey.

3. Financial Development and FDI

In addition to physical infrastructure, do foreign firms need locally developed financial services? In the current literature, little attention has been paid to this question compared to other determinants of FDI (wages, market size, etc.). The importance of financial services for foreign firms is two-fold. Like local firms, foreign firms can use financial services for overdraft facilities, loans, or payments to their suppliers of intermediate goods. Developed financial services also facilitate financial transactions between foreign firms and their customers and employees in the host country. More generally, financial development is an engine of economic growth, providing better business opportunities for customers and firms. Few studies have linked FDI location to financial development. With a sample of 81 foreign firms in Southern African countries, Jensink and Thomas (2002) show that South Africa attracts more FDI than the other countries in the region because of its better developed financial market. Deichmann et al. (2003) use the share of bank credits in the total economic activity as a proxy for financial development and find that this measure positively and significantly affects FDI in Turkey's regions. The authors conclude that financial development has the highest significance level among the determinants of FDI in the sector of services. Except for firms from Asia, financial services remain a significant determinant for the location of foreign firms from all regions. Financial development is also an important factor for the location of foreign firms in joint venture with Turkish companies or fully owned by MNEs[24]. Other studies have shown the complementarities between FDI and financial development in explaining economic growth (Alfaro et al., 2006; Alfaro et al. 2008).

Dollar et al. (2006) analyze the importance of the investment climate on export and FDI probability for eight Latin American and Asian countries using firm-level data. Their conclusions are drawn for all investment climate variables (which include

[24] Smith et al. (1997) linked foreign ownership of Slovene firms during the early years of privatization (1989-1992) to financial development measures (long/short term domestic/foreign credit). They find that firms with greater access to foreign credit (long-term and short-term credit) have higher participation of foreign firms in their capital.

physical and financial infrastructure variables) without giving the specific effect of a particular variable. The authors conclude that better investment climate in general encourages FDI.

4. Data and Descriptive Statistics

The data are drawn from enterprise surveys[25] in developing countries conducted by the World Bank. The surveys collect data on production variables, firms' characteristics, and quantitative and qualitative (perception-based) indicators of the investment climate. The survey in each country has been carried out between 2000 and 2006. This analysis considers 77 developing countries and 33,604 firms including 4,660 foreign firms. Firms' characteristic variables include information on the share of foreign ownership in firm capital but information such as the volume of foreign investment is not available[26]. The dependent variable (FDI) takes the value one if at least 10% of the firm's capital is foreign (following the IMF standard of FDI definition) and zero otherwise. The explanatory variables of first interest (physical and financial infrastructure) include firm's judgement of their constraints in transport, electricity, and access to finance constraints. They also account for financial under-development through the share of informal sources of financing (money lender, family and friends) in firms' working capital (accounts receivable, inventories and cash). As physical infrastructure variables, we also retain firms' access to e-mail and internet in their interactions with clients and suppliers. In accordance with the theory, control variables (institutional problems, lack of skilled workers, agglomeration, and firms' age and size) are included[27]. Appendix 3.1 gives the name and definition of all variables.

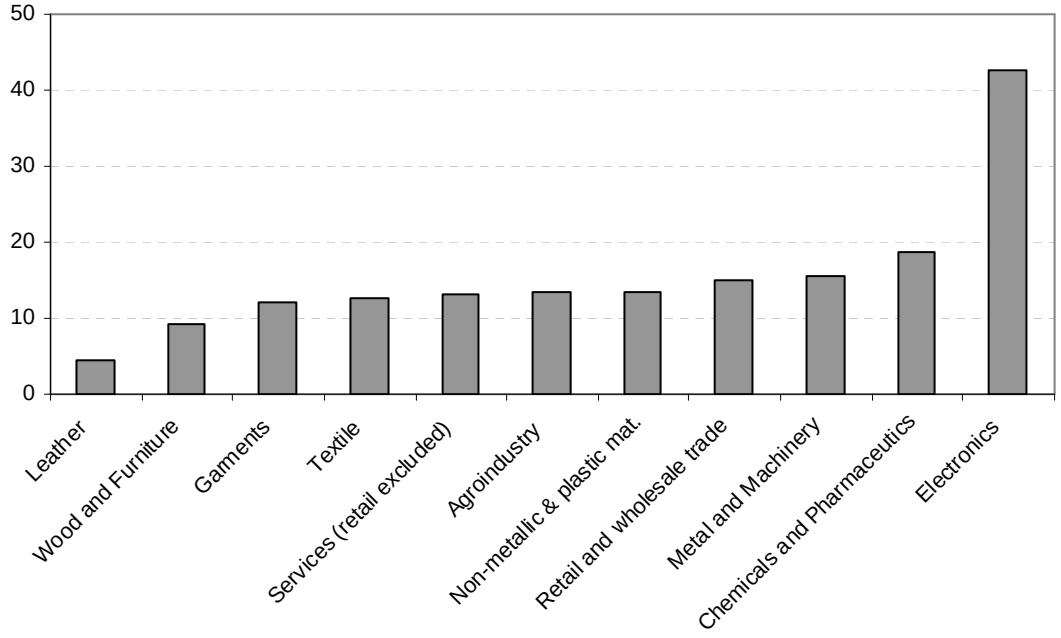
[25] Enterprise surveys (Investment Climate Analysis: ICA and the Business Environment and Enterprise Productivity Survey: BEEPS) are harmonized surveys of large and random samples of firms.

[26] A comprehensive discussion on ICA databases and their limits is presented in section 4 of chapter 5.

[27] Explanatory variables have been chosen for their economic relevance but also according to their number of non-missing values.

The proportion of foreign investors varies depending on the sector[28] (figure 3.1). High value sectors such as electronics, metal and machinery, chemicals and pharmaceutics attract more foreign investors compared to other sectors. Beyond the expected profits in these sectors, they require a large amount of investment during the set-up and operation. In this sample, 43% of firms in the electronics sector and 19% in the chemicals and pharmaceutics sector are partly or fully owned by foreign investors. Other sectors have on average 13% of foreign firms except the leather sector where 96% of firms are owned locally.

Figure 3.1: Share (%) of Foreign Firms by Sector



On average, foreign firms are larger (appendix 3.3) and export[29] more (particularly in the electronic sector, appendix 3.4). This is consistent with the theory of vertical FDI that states that firms break down their production processes in order to gain

[28] The sectors include in this analysis are textile, leather, garment, agroindustry (including food and beverage), metal & machinery (including automobile), electronics, chemicals & pharmaceutics, wood & furniture (including paper), non-metallic & plastic materials, retails & wholesale trade and services (excluding retail).

[29] Exporter firms are defined as firms exporting at least 10% of their sales.

advantages from low production costs in different locations and then export or re-export their productions.

Foreign and local firms in developing countries face many constraints when investing, operating or expanding their business. Based on firms' perception, financing problem is ranked as the most important investment climate constraint for firms (local and foreign) and foreign firms locate more where financing constraints are lower (figure 3.2 and 3.3). The analysis of sector-level data reveals that the severity of the constraints varies across sectors but foreign firms have on average the same constraints whatever their sector of activity. Problems of access to finance are ranked as the first constraint in all sectors. Firms in manufacturing and services sectors suffer from electricity problem but this constraint is more important for firms in the manufacturing sector.

Figure 3.2: Ranking of Investment Climate Constraints (all firms)

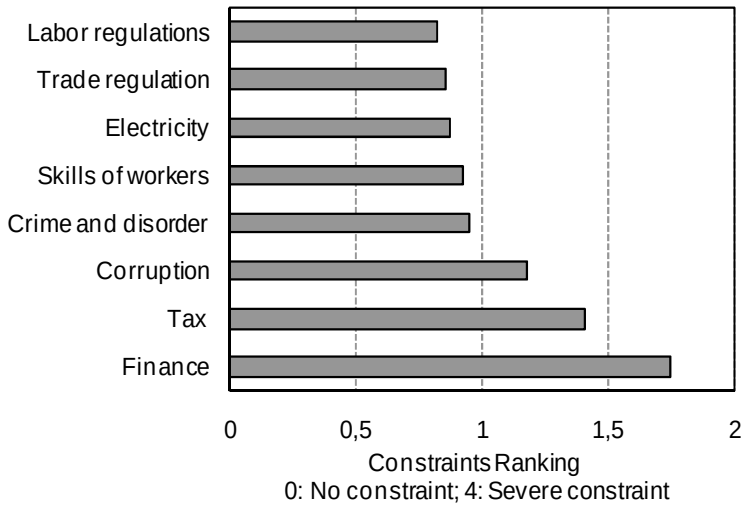
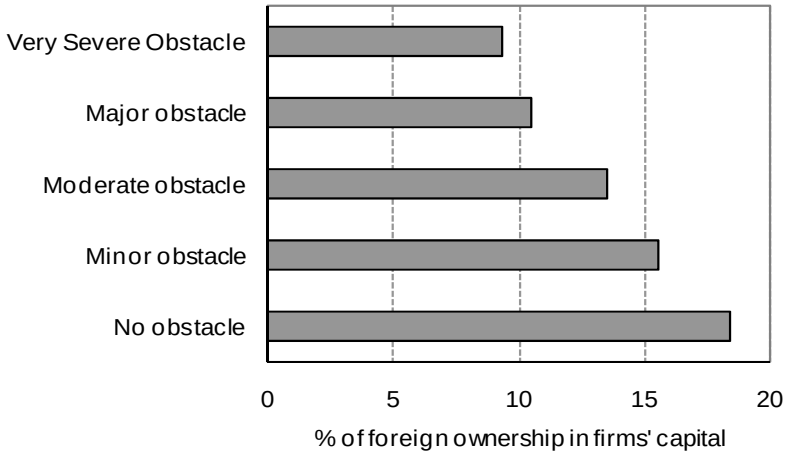


Figure 3.3: Foreign Ownership and Financing Constraint



Variables of interest (physical infrastructure constraints approximated by telecommunication problems and financing constraints approximated by the use of informal finance) are more objective variables compared to enterprises perceptions used in figure 3.2 and 3.3. Using these "more objective" variables, the following graphs (figure 3.4 and 3.5) highlight that foreign firms (FDI) locate less where telecommunication problems are higher and where firms rely more on informal source of financing (friends, family) for their business.

Figure 3.4: Telecom Problems and FDI

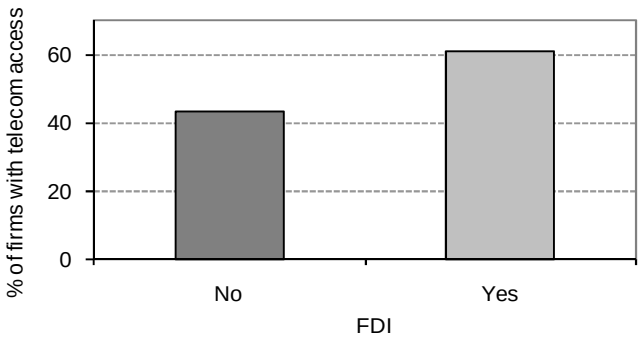
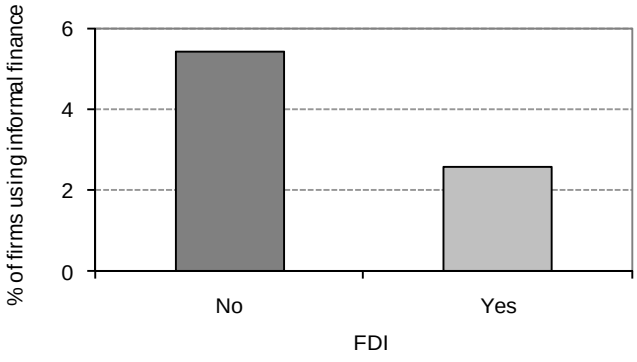


Figure 3.5: Informal Finance and FDI



Although these figures reveal surface level information about where foreign firms prefer to locate, a deeper analysis based on econometric estimations and including control variables is needed to go beyond these basic findings.

5. Econometric Analysis

5.1. Estimation

Contrary to classic FDI location studies that consider the different possible location of affiliates for each MNE, our study considers all affiliates in a country. In former studies, the dependent variable takes the value of one if the MNE chooses the country as the location of its affiliate and zero for other alternative locations. Most of the time, alternative locations are restricted to a group of countries because of data availability or the purpose of the study. This implies the exclusion of some alternative locations leading to potential bias. In this study, we consider the entire sample of firms in one country and estimate the probability for each firm to be foreign, given the characteristics of the different regions in the country. The chapter thus analyzes the stock of foreign firms relatively to the stock of total firms in a location and relates this measure to the local investment climate which is also a stock variable. We expect that countries, and within a country, regions with a better investment climate attract relatively more foreign firms. The empirical equation can be written as:

$$FDI_{ijk} = \beta_1 X_{ijk} + \beta_2 Z_{ijk} + \beta_3 V_i + \beta_4 U_j + \varepsilon_{ijk} \qquad (1)$$

FDI_{ijk} indicates whether firm k in country i and sector j is foreign owned or local. X_{ijk} is a matrix including structural constraints (physical and financial infrastructure problems, lack of human capital and low quality of institutions). Z_{ijk} is a matrix of other determinants of firm location (agglomeration effects, taxes, trade regulations or firms' specific factors such as size or age). By including V_i and U_j that are respectively country and sector fixed-effects, we explain the regional variation.

Explanatory variables are firstly based on objective information and use secondly firms' perception of investment climate constraints. Firm-level data can be the source of measurement errors. More productive or efficient firms (foreign firms) can also have a smaller feeling of investment climate constraints compared to less productive firms (local firms). Identical investment climate can then be assessed differently according to firms' performances and resources. These potential measurement errors

and reverse causality could lead to endogeneity. We define instruments that are the sector-region averages for each endogenous variable[30]. We also consider the sector-region average of the fact that firms' annual financial statements are reviewed or not by an external auditor as an instrument for the financial infrastructure variable. Identical procedure of instrumentation has been used by Aterido et al. (2007) and Honorati and Mengistae (2007). Since only 14% of firms' capital is foreign-owned, location-average of variables are dominated by small-local firms and are thus partly exogenous by definition (Dollar et al., 2005; Lall and Mengistae, 2005). The agglomeration variable is defined as the number of foreign firms by region in a specific sector and captures the average attractiveness of each region. The inclusion of this variable helps to control for the direct effect of the regional investment climate on FDI. The impact of location-average of the investment climate variables on FDI should be mainly through the firm-level information -as highlighted by the correlation between location-average variables and firm-level variables. This reduces the endogeneity stemming from the identifying exclusion restriction. A set of tests of validity of the instruments are performed in the following section.

Enterprises surveys include many variables explaining identical phenomena. For instance, variables related to financing constraints include access to finance as collateral requirement and, access to finance as the share of firms' working capital coming from friends and informal sources. Simultaneous introduction of these variables in a single regression could lead to a colinearity problem. A solution is the generation of aggregated indices or the choice of a single variable per phenomenon. We use Principal Component Analysis (PCA) and standardization methods to generate aggregated indices[31].

[30] We make sure to get sufficiently large number of firms for each region in each sector.

[31] Standardization method is similar to PCA but it gives the same weight to all components of the index. Physical infrastructure index includes firms' perception of transport and electricity problems as well as telecommunication opportunities (captured by firms' access to e-mail and website in their interaction with clients and suppliers). Financial development index includes firms' perception of their

5.1.1. Results

Firstly, we estimate the impact of the index of physical and financial infrastructure on the probability to receive FDI *(1)*. We then consider the physical infrastructure index separately from the financial infrastructure index *(2)* and finally we use a single objective variable for each type of infrastructure *(3)*.

problems to access finance and the share of firms' financing from informal sources (money lender, family and friends) in firms' working capital.

Table 3.1: Basic model with infrastructure variables

	Dependent variable : FDI					
	(1)		(2)		(3)	
	2SLS	**IV FE Logit**	**2SLS**	**IV FE Logit**	**2SLS**	**IV FE Logit**
Age	-0.002 (8.09)***	-0.002 [0.98] (12.83)***	-0.002 (8.33)***	-0.002 [0.98] (13.55)***	-0.002 (7.42)***	-0.002 [0.98] (11.04)***
Size (20-99 employees)	0.043 (5.53)***	0.047 [1.63] (9.16)***	0.044 (5.11)***	0.049 [1.66] (9.75)***	0.028 (3.30)***	0.033 [1.43] (6.05)***
Size (>=100 employees)	0.153 (9.57)***	0.140 [3.33] (18.75)***	0.163 (9.41)***	0.156 [3.73] (20.87)***	0.129 (7.74)***	0.110 [2.69] (12.93)***
Agglomeration	0.000 (0.34)	0.000 [1.00] (1.53)	-0.000 (0.04)	0.000 [1.00] (0.31)	0.000 (0.27)	0.000 [1.00] (1.95)*
Infrastructure problems	-0.136 (11.10)***	-0.123 [0.25] (18.79)***				
Physical Infrast. problems			-0.265 (9.91)***	-0.235 [0.07] (16.38)***		
Financial Infrast. problems			-0.026 (2.60)***	-0.026 [0.74] (3.81)***		
Telecom problems					-0.246 (9.68)***	-0.218 [0.09] (18.37)***
Informal finance					-0.001 (3.15)***	-0.001 [0.98] (3.85)***
Observations	33604	33604	33604	33604	33604	33604
Number of countries	77	77	77	77	77	77
R^2/Pseudo R^2	0.05	0.10	0.05	0.11	0.05	0.10
% of correct prediction		70.63		70.71		70.62
Weak instrument diagnostic						
Infrastructure/Physical Infrast.						
Partial R^2		0.10		0.03		0.11
Shea partial R^2		0.10		0.03		0.11
Partial F		3247.4		190.4		2822.65
[p-value]		[0.000]		[0.000]		[0.000]
Financial Infrast.						
Partial R^2				0.08		0.08
Shea partial R^2				0.08		0.08
Partial F				1672.8		61309.5
[p-value]				[0.000]		[0.000]
Cragg-Donald Stat.	1972.6		374.0		987.6	
Critical value (10%)	19.93		13.43		13.43	

Clustered z statistics (absolute value) at country level in parentheses.
All regressions include country and sector fixed effects. The reference for size dummies is small size (less than 20 employees).
For logit regression, bootstrapped (with 100 replications) z statistics clustered at country level in parentheses.
Coefficients reported for logit regression are marginal effects. Next to marginal effects, odds ratios are reported in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.
First-stage regressions (not reported for conciseness) are available upon request.

Estimation methods include a linear probability model with instrumentation and a fixed-effect logit with instrumentation. The instrumental logit fixed-effect (IV FE logit) estimations imply two-stage procedures leading to consistent parameters but incorrect estimated variances. Through resampling based on the sample data, we approximate standard errors by the bootstrap method and obtain proper standard errors that are reported. Attention is also given to the linear probability model (Two-Stage Least Squares: 2SLS) which, despite some disadvantages, provides a good approximation of the logit specification and allows a better handling of the unobservable heterogeneity and weak instruments diagnostic. Since the explanatory variables include firms' perceptions or are based on firms' answers, the endogeneity issue is a serious concern as discussed above. The validity of the results depends on the quality of the instruments[32]. As instruments diagnostic tests, we rely mainly on some statistics of the first-stage estimations (partial R^2, Shea partial R^2, partial F-statistic, and Cragg-Donald weak instrument test). The correlations between endogenous variables and excluded instruments are confirmed by the values of partial R^2 values, which are above zero. Since we have more than one endogenous variable in some cases, comparison between the standard partial R^2 and Shea partial R^2 -which controls for the correlation between instruments- can be relevant. These two statistics are similar in this study, indicating low correlation between instruments and therefore no concern as indicated by Baum, Schaffer and Stillman (2003). In addition, we obtain large and significant *F* statistics in the first stage regressions[33]. A growing test of weak instruments in the literature is the comparison of Cragg-Donald statistics to critical values computed by Stock and Yogo (2004). Cragg-Donald statistics in this chapter are far higher than the Sotck and Yogo critical values, indicating the absence of the weak instruments problem.

Including only firm-level determinants (age and size) and the agglomeration variable, basic regressions linking infrastructure constraints (aggregated indices as well as

[32] We validate the over-identification tests that we consider as minimum requirements.

[33] These statistics are more relevant for the first two estimations in which only one variable is endogenous.

individual variables) to FDI show a strong negative relationship[34]. These regressions include only variables of first interest but the theoretical background underlined the importance of other structural factors such as institutional quality and the availability of skilled workers. The following estimations control for these additional factors.

[34] The results are similar using firms' perception of their constraints of infrastructure. Gelb et al. (2007), after controlling for country and sector fixed-effects show that firms' perceptions are significantly correlated with objective variables of enterprises surveys and external measures of the investment climate (doing business).

Table 3.2: Basic model including other structural factors

	Dependent variable : FDI					
	(1)		(2)		(3)	
	2SLS	**IV FE Logit**	**2SLS**	**IV FE Logit**	**2SLS**	**IV FE Logit**
Age	-0.002	-0.002 [0.98]	-0.002	-0.002 [0.98]	-0.002	-0.001 [0.98]
	(7.92)***	(13.00)***	(8.03)***	(12.5)***	(7.48)***	(11.33)***
Size (20-99 employees)	0.040	0.044 [1.59]	0.038	0.043 [1.57]	0.028	0.033 [1.42]
	(4.91)***	(7.89)***	(4.44)***	(7.64)***	(3.25)***	(5.90)***
Size (>=100 employees)	0.147	0.133 [3.18]	0.150	0.138 [3.31]	0.128	0.109 [2.69]
	(9.08)***	(14.64)***	(8.95)***	(17.28)***	(7.78)***	(12.96)***
Agglomeration	0.000	0.000 [1.00]	-0.000	-0.000 [1.00]	0.000	0.000 [1.00]
	(0.31)	(1.04)	(0.10)	(0.83)	(0.33)	(2.05)**
Infrastructure problems	-0.138	-0.125 [0.25]				
	(11.15)***	(17.51)***				
Physical Infrast. problems			-0.254	-0.225 [0.08]		
			(10.13)***	(19.52)***		
Financial Infrast. problems			-0.038	-0.036 [0.67]		
			(3.88)***	(5.65)***		
Telecom problems					-0.251	-0.223 [0.08]
					(9.62)***	(15.80)***
Informal finance					-0.001	-0.001 [0.99]
					(3.21)***	(3.30)***
Skilled labor problems	0.019	0.013 [1.16]	0.043	0.036 [1.49]	-0.002	-0.006 [0.94]
	(1.76)*	(2.64)***	(3.30)***	(6.37)***	(0.23)	(1.11)
Crime and disorder	0.000	0.001 [1.01]	0.031	0.027 [1.36]	-0.022	-0.019 [0.80]
	(0.05)	(0.11)	(2.88)***	(4.88)***	(2.48)**	(3.96)***
Observations	33604	33604	33604	33604	33604	33604
Number of countries	77	77	77	77	77	77
R^2/Pseudo R^2	0.05	0.10	0.05	0.11	0.05	0.11
% of correct prediction		70.60		70.78		70.75
Weak instruments diagnostic[a]						
Infrastructure/Physical Infrast.						
Partial R^2		0.11		0.05		0.12
Shea partial R^2		0.11		0.04		0.11
Partial F		1610		163		1687
[p-value]		[0.000]		[0.000]		[0.000]
Financial Infrast.						
Partial R^2				0.08		0.08
Shea partial R^2				0.08		0.08
Partial F				1099		38206
[p-value]				[0.000]		[0.000]
Cragg-Donald Stat.	790.9		271.8		590.1	

Clustered z statistics (absolute value) at country level in parentheses.
All regressions include country and sector fixed effects. The reference for size dummies is small size (less than 20 employees).
For logit regression, bootstrapped (with 100 replications) z statistics clustered at country level in parentheses.
Coefficients reported for logit regression are marginal effects. Next to marginal effects, odds ratios are reported in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.
[a] Weak instruments tests of other variables (skilled worker problems and crime or disorder) not reported here give partial R^2 and Shea partial R^2 between 0.08 and 0.10 and large F-statistics (far above 10). The latter statistics may not be very relevant for weak instrument diagnostic in this context. Stock and Yogo critical values are available for up to three endogenous regressors.
First-stage regressions (not reported for conciseness) are available upon request.

Controlling for institutional problems and human capital constraints, the results are similar for the variables of interest (physical and financial infrastructure). We consider firms' perception of crime, theft and disorder as a proxy for institutional quality and firms' perception of the availability of skilled workers as a proxy for human capital. To address the endogeneity issue explained above, these variables are instrumented by their sector-region averages.

The results show that on average, larger and younger firms are more likely to be foreign. The agglomeration effect, which captures the positive or negative externalities of foreign firms in a specific region and sector, has no effect[35]. With respect to the main variables, we find that the index of constraints in physical and financial infrastructure negatively and significantly affects FDI. The results are similar using one index by form of infrastructure (physical and financial) or single variables. The results are also robust to estimation methods (instrumental variables with fixed-effect logit and simple instrumental variables approach). Regions with better access to telecommunications, or formal credit (through the banking system for instance) attract more foreign investments. Indeed, a marginal increase in infrastructure constraints reduces the odds of receiving FDI by 75%. A breakdown of the aggregate infrastructure index shows that a marginal increase in physical infrastructure problems decreases the probability of receiving FDI by 92% while the same increase in financing constraints reduces the probability of attracting FDI by 33%. Single variables of infrastructure (physical and financial) also lead to similar conclusion. The availability of roads and transport facilities, a reliable provision of electricity, and a well-functioning telecommunication system allow and encourage economic activities, particularly industrial activities, thereby attracting foreign firms. Financing opportunities for firms and consumers in local credit markets also encourage foreign firms' activities during setting up, operation, or expansion.

Additional structural factors (availability of skilled workers and institutional problems) also affect attractiveness to FDI. The lack of skilled workers has a negative effect on

[35] Non-linearity tests of the agglomeration effect are not significant.

FDI using aggregated infrastructure indices. Even if this finding is not robust to different specifications (with non-aggregated infrastructure variables), the vertical FDI theory which states that firms look for cheap low-skilled workers in developing countries support this result. The effect of institutional problems (crime, theft, and disorder) is not stable across specifications. We will return to these two variables (human capital and institution) in the robustness checks.

5.1.2. Deeper analyses and robustness checks[36]

FDI theory defines two major forms of FDI (vertical and horizontal) with different motives and therefore different determinants. Using the share of exports in firms' sales, a breakdown analysis between exporting and non-exporting firms helps to get a deeper understanding of the importance of infrastructure for each form of FDI. According to the structure of ownership, foreign firms' criteria to invest in a country could differ. Foreign firms may prefer a joint venture with local partners in order to reduce risks when investing in a foreign country (Smarzynska and Wei, 2000). Local partners have likely more and better information on the host country. The criteria to invest abroad may also vary with the degree of foreign ownership in a joint venture. Beyond the inclusion of sector fixed-effects in all regressions, a breakdown analysis by sector gives a more complete picture of the importance of infrastructure for the manufacturing sector, compared to services or the effect of infrastructure across different manufacturing activities. Another robustness check assesses the validity of the results after the inclusion of additional explanatory variables reflecting institutions, taxes, regulation policies and market size. The last analysis in this section compares the poorest group of countries (Sub Saharan Africa) to other developing countries and investigates the heterogeneity in the impact of structural variables across countries.

Breakdown by export status: Exporter versus non exporter firms

This breakdown allows testing for the difference between local market-oriented FDI (horizontal FDI) and export-oriented FDI (vertical FDI) and assesses how investment

[36] Only results of 2SLS regressions, which are similar (sign and significance) to those obtained with logit specification are reported in this section.

climate affects horizontal FDI versus vertical FDI[37]. As suggested by the theory, horizontal FDI should be more affected by market potential and vertical FDI by factor costs (mainly unit labor cost or wages). Considering the breakdown by form of FDI, results show that physical infrastructure is important for attracting foreign firms whether they export or sell their production locally (appendix 3.10). These results indicate that infrastructure problems are serious obstacles. For instance, telecommunication problems could impede interactions between firms' suppliers and their foreign customers. More specifically, foreign firms exporting their production are statistically more affected by telecommunication problems compared to firms supplying the local market. This result illustrates that infrastructure problems, with the typical example of telecommunication problems, are obstacles that are more serious for firms supplying their foreign customers and interacting with them by phone or internet. Financial under-development affects firms and the economy in general as explained in the theoretical section. Empirical results show that foreign firms selling their productions locally are more affected by financing constraints compared to firms exporting their production. Indeed, exporter and non-exporter foreign firms suffer from financing constraints during the production process but non-exporter firms are also affected by the broader financial under-development of the economy that affects their clients[38]. Exporting firms are also statistically more affected by a shortage of skilled worker compared to firms supplying the local market. This suggests that exporter firms are engaged in more skilled intensive activities compared to non-

[37] The breakdown of exporter versus non-exporter firms does not allow a complete separation of vertical and horizontal FDI. This paper has the strength to address this issue but some aspects of the breakdown (direction of affiliate sales) should also be considered. If the exports of an affiliate are mainly for the home country, this type of FDI can be classified as vertical FDI. If the exports are for a third country or the production sales domestically, the FDI in this case could be considered as horizontal. Our data does not allow this distinction of the destination of exports. Most of the time, it is very difficult to distinguish the two types of FDI in the data and both types of investment (vertical and horizontal) coexist in general.

[38] This interpretation mainly supposes that financing constraints in the destination country of exporter firms are less than financing constraints in the home country (country of production). That is not necessary the case.

exporter firms. Institutional problems (disorder, crime and theft) affect both groups of firms. The results are similar with exporter firms defined as firms exporting at least 10% of their production or as firms exporting any part of their production.

Analysis across ownership degree: from local to joint-venture to foreign fully-owned firms

Factors determining the location of foreign firms may vary with the degree of ownership. Previous analyses in this chapter were based on a dichotomous variable. This variable captures only the fact that the firm is local or foreign regardless of the degree of foreign ownership that can range from local to joint venture to foreign. This section assesses how investment climate, particularly physical and financial infrastructure could affect the degree of foreign ownership. The hypothesis being that the impact of infrastructure varies and is higher with the degree of foreign ownership. Foreign firms may look for a local partner in a joint venture when they plan to invest in a country with important infrastructure constraints or political instability. Foreign firms' investments through a joint venture aim to reduce information costs on the local market (particularly for new firms). To analyze this issue, we use 2SLS and two limit Tobit with instrumentation[39].

The results show that physical and financial infrastructure constraints negatively and significantly affect foreign ownership. In regions with infrastructure and financing constraints, foreign investors participate less in firms' capital. As predicted, the downward bias is observed with the OLS method. The impact of infrastructure variables and other control variables are lower with OLS method compared to the Tobit estimation. The results also highlight that institutional problems reduce the share of foreign participation in firms' capital (appendix 3.10).

[39] This method is more relevant because of the high number of firms which are fully owned by local investors or by foreign investors leading to an important number of observations in the upper and the lower limit of the distribution of the foreign ownership variable (which is confined into the interval [0,1]). Standard OLS would lead to downward bias in the predicted ownership degree.

Breakdown by sector

FDI determinants could vary across sectors. Firms in service sectors could be more attracted by the availability of human capital (skilled workers), whereas manufacturing firms could be more attracted by good infrastructure. The manufacturing sector is also heterogeneous so that firms in the various industries could be differently affected by the same factors. All the regressions included sector fixed-effects in order to take into account this heterogeneity. This section helps to check if the aggregated (all sectors combined) impact of infrastructure is driven by one sector, or if all sectors show the same pattern (appendix 3.11). In most sectors, the availability of well functioning infrastructure increases the probability of receiving FDI. Physical and financial infrastructure constraints decrease the probability of receiving FDI in four sectors: textile, garment, metal and machinery, and retails. FDI in agro-industry, electronics, wood & furniture, non-metallic & plastic materials, and services sectors are negatively and significantly affected by physical infrastructure constraints while financial development affects FDI in the leather sector. Only FDI in the chemical sector is not affected by physical infrastructure and financial development. These results show that infrastructure problems are important constraints regardless of the sector, and they highlight the crucial role of physical infrastructure for developing countries attractiveness to FDI.

Additional control variables

Explanatory variables have been chosen according to their economic relevance and considering their number of non-missing values. This robustness check includes a higher number of control variables, leading to more missing values. Firms' perception of crime, theft and disorder in the baseline regressions is replaced by a variable closer to the quality of institutions in line with economic activity: property rights protection[40]. Additional control variables are consecutively firms' perception of labor regulation, corruption, customs and trade regulations, tax rates, and wages (appendix 3.12). The

[40] The introduction of the variable of property rights protection leads to higher missing values compared to the variable of theft, disorder and crime. This is not a concern in this section since the additional control variables lead to approximately the same number of missing values.

last variable (wages) proxies the labor cost and is measured by sector-region averages of wage per employee. To address the endogeneity issue, each variable is instrumented by its sector-region average. Additional explanatory variables also help to reduce the endogeneity problem due to omitted variables bias. Including additional variables cumulatively, physical and financial infrastructure constraints remain significant and negatively affect FDI. Corruption and tax rate negatively and significantly affect FDI. However, customs and trade regulations increase FDI. This result is supported by the horizontal FDI theory. Since horizontal FDI aim to supply the local market, the theory suggests that trade barriers could represent indirect protections for firms located in the country, giving them price advantages.

Sub-Saharan Africa specificity

As mentioned in the literature review, most analyses on developing countries have focused on China. Enterprises surveys allow an analysis including an important number of African countries, the least developed countries and those with the highest investment climate constraints. This study thus gives the first picture of FDI determinants in Africa using firm level data[41]. Physical infrastructure constraints negatively and significantly affect FDI in Sub-Saharan African (SSA) countries as well as in other developing countries. The size of this negative impact is not statistically different between the two groups (appendix 3.13). The availability of a well-functioning telecommunication system increases the probability of receiving FDI in SSA and in other developing countries. Financing problems also discourage FDI in SSA countries and in other developing countries. Social instability captured by theft, disorder and crime problems is statistically more relevant for SSA countries compared to other developing countries. This result is consistent with expectations since compared to other developing countries, a larger number of SSA countries suffer from civil war and violent protests. As indicated in previous sections, trade and customs regulations encourage FDI following horizontal FDI theory. Tax rate discourages FDI in other developing countries but not in SSA countries. This finding supports the theoretical

[41] We first verify the specificity of Sub-Sahara African countries by including an African dummy variable in the whole sample.

hypothesis according to which tax incentives should have lower impact in developing countries (compared to developed countries), given their structural problems (infrastructure, institution, etc.). Indeed, tax incentives or subsidies cannot easily compensate structural problems of infrastructure, institutions, and market access in developing countries and attract foreign investments, particularly in the manufacturing sector. Since SSA countries are among the least developed ones, tax incentives have a lower effect in this region compared to other developing countries.

Appendix 3.14 analyzes the heterogeneity in the impact of structural factors on FDI at the country level. This implies running single estimation by country. In almost all countries, investment climate constraints (particularly physical and financial infrastructure problems) reduce FDI. These findings highlight that a particular country or group of countries does not drive the results.

6. Conclusion

Attracting foreign direct investment is a key issue in the developing and developed world. This paper analyzes how investment climate constraints jeopardize developing countries attractiveness for FDI. Using firm-level data for 77 developing countries, it provides the first empirical analysis of the importance of the investment climate for FDI with a large sample of developing countries. As investment climate constraints, we focused on physical and financial infrastructure problems in addition to human capital and institutional constraints. The main results show that improving physical and financial infrastructure as well as institutional quality increases the probability of receiving a foreign firm.

A breakdown analysis between exporter and non-exporter firms shows that foreign firms supplying foreign markets are more heavily affected by physical infrastructure problems but financing constraints have a higher effect on foreign firms supplying local markets. Exporter firms are also more affected by the lack of skilled workers compared to foreign firms supplying the local market. The results are robust to an alternative definition of foreign ownership, an analysis by sector, and the inclusion of additional explanatory variables. Adding new explanatory variables, we find that

corruption and tax rate are among the obstacles for attractiveness to FDI. However, trade and customs regulations encourage FDI. This finding follows the theory of horizontal FDI, according to which firms aiming to supply the local market may look for protected countries with high trade barriers, giving them price advantages. Physical infrastructure constraints and financing problems are major constraints for foreign firms in SSA and in other developing countries. The results also highlight the importance of institutional quality in attracting FDI to developing countries, particularly to Sub-Saharan African (SSA) countries. The comparison between SSA countries and other developing countries also reveal that tax issue is relevant for other developing countries but not for SSA countries.

When designing policies to attract foreign investments, developing countries should pay particular attention to infrastructure (physical and financial) and institutions. Given the scarcity of public spending in developing countries, this chapter offers some basic guidelines to help governments design priorities in their budget with a better awareness of which type of investments tend to crowd in FDI, well needed to foster their long-term growth.

Appendices

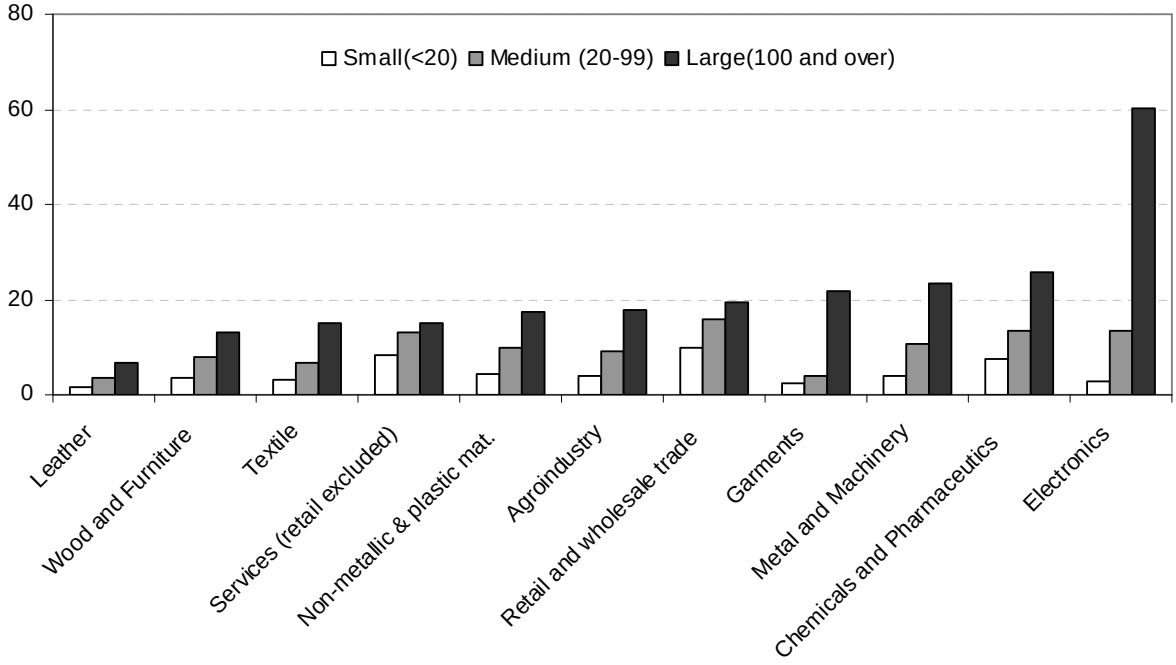
Appendix 3.1: List of variables

Variable	Definitions
FDI	Dummy equal 1 if at least 10% of firm capital is foreign
Age	Firm age
Size	Firm Size: 3 categories based on permanent & temporary workers
Agglomeration	Number of foreign firms in same sector and same region
Telecom problems 1	Access to e-mail for business with clients & suppliers (dummy variable)
Telecom problems 2	Access to website for business with clients & suppliers (dummy variable)
Electricity problems	Business constraint: electricity
Transport problems	Business constraint: transport
Informal finance problems	Informal sources of financing in firms' working capital (%)
Access to finance problems	Business constraint: access to finance (e.g. collateral)
External auditor	Annual financial statement reviewed by external auditor (dummy variable)
Skilled labor problems	Business constraint: skills of available workers
Crime and disorder	Business constraint: crime, theft, disorder
Property right	Confident judicial system will uphold property rights
Labor regulation	Business constraint: labor regulations
Corruption	Business constraint: corruption
Custom and trade	Business constraint: customs and trade regulations
Tax rates	Business constraint: tax rates
Wage	Sector-region average wage per employee

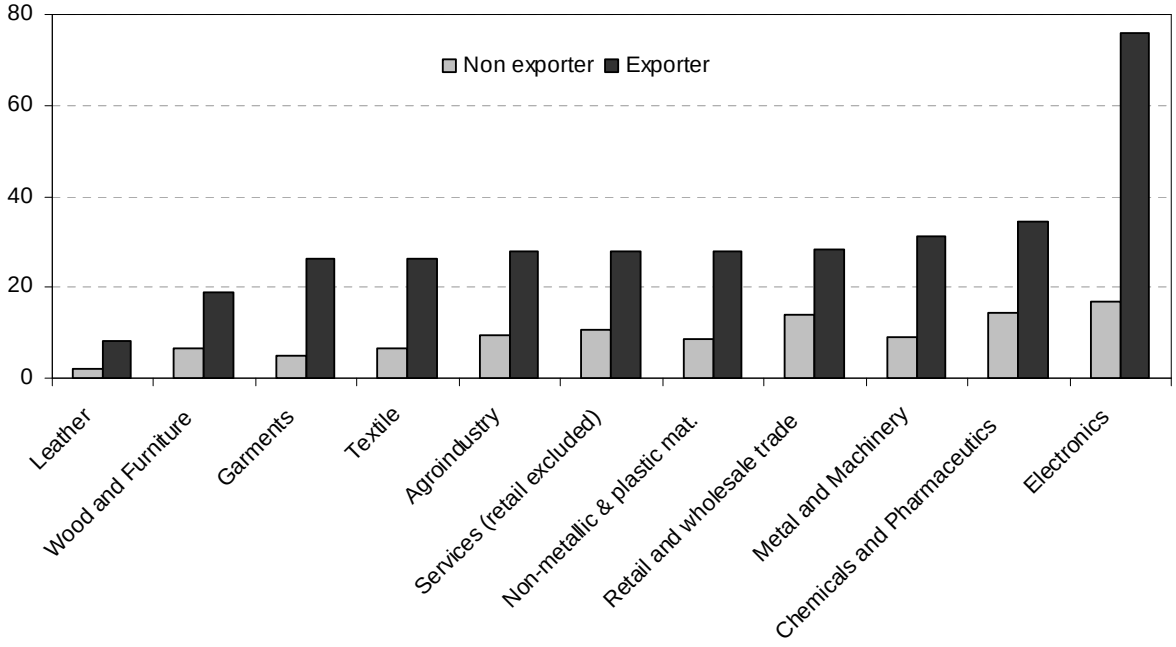
Appendix 3.2: Descriptive statistics

Variable	Mean	Std. Dev.	Minimum	Maximum	Observation
FDI	0.14	0.35	0	1	33604
Telecom problems 1	0.64	0.48	0	1	33604
Telecom problems 2	0.45	0.50	0	1	33604
Electricity problems	0.87	1.24	0	4	33604
Transport problems	0.62	1.05	0	4	33604
Informal finance problems	5.03	16.72	0	100	33604
Access to finance problems	1.13	1.34	0	4	33604
External auditor	0.50	0.50	0	1	33085
Skilled labor problems	0.92	1.18	0	4	33604
Crime and disorder	0.95	1.28	0	4	33604
Property right	3.55	1.45	1	6	23500
Labor regulation	0.82	1.15	0	4	32226
Corruption	1.18	1.42	0	4	33145
Custom and trade	0.85	1.22	0	4	31698
Tax rates	1.40	1.39	0	4	33491
Age	17.08	17.50	0	202	33604
Agglomeration	27.04	28.36	0	144	33604
Wage	179.65	4554.57	0	400691	15685
Number of permanent workers	138.26	495.48	0	19047	33471

Appendix 3.3: Share of foreign firm by sector and size



Appendix 3.4: Share of foreign firm by sector and export status



Appendix 3.5: Ranking of investment climate constraints by sector

Sector	Finance	Tax	Corruption	Crime and D.	Skills of W.	Electricity	Trade Regul.	Labor Regul.
Textile	2,05	1,42	1,42	1,11	1,17	1,31	1,17	0,94
Leather	2,66	2,19	2,04	1,60	1,50	1,48	1,49	1,30
Garments	2,02	1,52	1,50	1,25	1,15	1,09	1,06	1,09
Agroindustry	1,76	1,40	1,18	0,99	0,94	1,10	0,86	0,83
Metal and M.	1,84	1,59	1,27	0,98	1,11	0,80	1,01	1,03
Electronics	1,78	1,75	1,75	1,44	1,35	1,64	1,72	1,37
Chemicals	1,88	1,08	1,07	0,86	0,76	0,84	0,82	0,68
Wood and F.	2,04	1,79	1,56	1,21	1,28	1,20	0,99	1,09
Non-metallic M.	1,64	1,25	1,14	0,92	1,00	1,08	0,69	0,73
Services	1,36	1,26	0,88	0,72	0,71	0,52	0,55	0,65
Retail and W.	1,51	1,21	0,84	0,67	0,55	0,43	0,68	0,51

Appendix 3.6: Correlation of physical and financial infrastructure variables

	Access to finance p.	Informal finance p.	Electricity p.	Transport p.	Telecom p. 1	Telecom p. 2
Access to finance p.	1.00					
Informal finance p.	0.06*	1.00				
Electricity p.	0.32*	0.01	1.00			
Transport p.	0.34*	0.03*	0.56*	1.00		
Telecom p. 1	0.02*	0.09*	0.05*	-0.05*	1.00	
Telecom p. 2	-0.02*	0.08*	0.08*	-0.02*	0.61*	1.00

* significant at 1%. p indicates problem.

Appendix 3.7: Principal components analysis of physical and financial infrastructure variables

Principal components	Eigenvalue	Difference	Proportion of variance	Cumulative Variance
1	1.83	0.20	0.31	0.31
2	1.64	0.65	0.27	0.58
3	0.98	0.25	0.16	0.74
4	0.73	0.30	0.12	0.86
5	0.43	0.05	0.07	0.94
6	0.39	.	0.06	1.00

	Eigenvectors					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
Access to finance problems	0.49	-0.08	0.11	0.86	-0.03	0.09
Informal finance problems	0.08	0.17	0.97	-0.16	-0.04	0.01
Electricity problems	0.61	-0.03	-0.13	-0.35	-0.69	-0.08
Transport problems	0.60	-0.15	-0.05	-0.33	0.71	0.01
Telecom problems 1	0.09	0.69	-0.11	0.10	0.10	-0.70
Telecom problems 2	0.10	0.68	-0.14	-0.04	0.02	0.71

Physical and Financial Infrastructure index =
*(0.31/0.58)*Component 1 + ((0.58 -0.31)/0.58)*Component 2*

Appendix 3.8: Principal components analysis of physical infrastructure variables

Principal components	Eigenvalue	Difference	Proportion of variance	Cumulative Variance
1	1.63	0.08	0.41	0.41
2	1.55	1.11	0.39	0.79
3	0.43	0.04	0.11	0.90
4	0.39		0.10	1.00

Variable	1	2	3	4
Electricity problems	0.30	0.64	-0.70	0.08
Transport problems	0.19	0.69	0.70	-0.05
Telecom problems 1	0.66	-0.25	0.12	0.70
Telecom problems 2	0.67	-0.22	-0.01	-0.71

Physical Infrastructure index =
*(0.41/0.79)*Component 1 + ((0.79-0.41)/0.79)*Component 2*

Appendix 3.9: Principal components analysis of financial infrastructure variables

Principal components	Eigenvalue	Difference	Proportion of variance	Cumulative Variance
1	1.06	0.12	0.53	0.53
2	0.94		0.47	1.00

Variable	1	2
Access to finance problems	0.71	0.71
Informal finance problems	0.71	-0.71

Financial Infrastructure index = Component 1

Appendix 3.10: Breakdown by export status and foreign ownership

	Dependent variable: FDI				Dependent variable: foreign ownership	
	2SLS	**2SLS**	**2SLS**	**2SLS**	**2SLS**	**IV Tobit**
	(1)		**(2)**		**(3)**	
	Non-exporter[b]	**Exporter**	**Non-exporter**	**Exporter**		
Telecom problems	-0.191	-0.281	-0.187	-0.280	-0.204	-2.843
	(7.26)***	(4.59)***	(7.25)***	(4.86)***	(8.51)***	(17.70)***
Informal finance	-0.001	-0.003	-0.001	-0.003	-0.001	-0.017
	(1.73)*	(1.24)	(1.58)	(1.48)	(2.71)***	(3.67)***
Skilled labor problems	0.004	-0.048	0.006	-0.037	-0.003	-0.083
	(0.46)	(2.50)**	(0.78)	(1.95)*	(0.33)	(1.18)
Crime and disorder	-0.020	-0.030	-0.018	-0.041	-0.017	-0.222
	(2.86)***	(1.27)	(2.47)**	(2.09)**	(2.29)**	(3.28)***
Age	-0.001	-0.004	-0.001	-0.003	-0.002	-0.018
	(5.05)***	(7.87)***	(5.89)***	(6.80)***	(7.63)***	(13.66)***
Size (20-99 employees)	0.020	0.084	0.019	0.070	0.018	0.392
	(2.71)***	(4.45)***	(2.57)**	(4.34)***	(2.41)**	(6.33)***
Size (>=100 employees)	0.078	0.199	0.068	0.178	0.100	1.171
	(4.87)***	(9.19)***	(4.14)***	(9.27)***	(6.68)***	(13.51)***
Agglomeration	0.000	-0.000	0.000	-0.000	0.000	0.003
	(1.59)	(0.50)	(1.37)	(0.22)	(0.39)	(3.09)***
Observations	26460	7031	24543	9061	33604	33604
Number of countries	77	77	77	77	77	77
Weak instrument diagnostic[a]						
Telecom problems						
Partial R^2	0.11	0.08	0.10	0.08	0.12	0.12
Shea partial R^2	0.10	0.08	0.10	0.08	0.11	0.11
Partial F	1039	36	884	39	1687	1687
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Informal finance						
Partial R^2	0.08	0.06	0.08	0.07	0.08	0.08
Shea partial R^2	0.08	0.06	0.08	0.07	0.08	0.08
Partial F	912	27	771	35	38206	38206
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Cragg-Donald Stat.	475.9	77.9	441.6	122.7	590.1	

Clustered z statistics (absolute value) at country level in parentheses. All regressions include country and sector fixed effects For tobit regression, bootstrapped (with 100 replications) z statistics clustered at country level in parentheses. The tobit regression includes countries and sector dummies.

* significant at 10%; ** significant at 5%; *** significant at 1% The reference for size dummies is small size (less than 20 employees).

[a] Weak instruments diagnostic tests of other control variables (additional structural factor: skilled worker problems and crime or disorder) not reported here give partial and Shea partial R^2 between 0.08 and 0.10 and large F-statistics.

Results are confirmed by statistical test of the significance of the difference in the estimated coefficients between exporters and non-exporters firms. First-stage regressions (not reported for conciseness) are available upon request.

[b] Exporter are defined as firms exporting at least 10% of their sales in *(1)* and as firms exporting any part of their sales in *(2)*.

Appendix 3.11: Estimations by sector

	Dependent variable : FDI										
	Textile	**Leather**	**Garment**	**Agro**	**Metal**	**Electronics**	**Chemical**	**Wood**	**Non-metal.**	**Retails**	**Services**
Telecom problems	-0.284	0.097	-0.211	-0.241	-0.224	-0.711	-0.066	-0.132	-0.212	-0.245	-0.363
	(3.82)***	(1.02)	(2.64)***	(5.92)***	(3.88)***	(2.64)***	(0.78)	(2.21)**	(3.24)***	(6.10)***	(7.11)***
Informal finance	-0.004	0.004	-0.004	0.000	-0.003	-0.005	0.003	0.001	-0.002	-0.002	0.001
	(3.92)***	(2.58)***	(5.09)***	(0.14)	(2.17)**	(0.99)	(1.29)	(1.19)	(0.86)	(2.27)**	(0.48)
Skilled labor prob.	-0.047	-0.014	-0.009	-0.015	0.026	0.026	0.069	-0.011	-0.016	0.018	-0.039
	(1.20)	(0.41)	(0.34)	(0.73)	(0.83)	(0.19)	(1.72)*	(0.43)	(0.53)	(0.59)	(1.30)
Crime and disorder	0.039	-0.045	-0.067	0.004	-0.025	0.040	-0.019	-0.020	-0.055	-0.002	-0.039
	(1.63)	(1.71)*	(1.98)**	(0.29)	(0.85)	(0.65)	(0.41)	(1.32)	(1.56)	(0.08)	(1.38)
Age	-0.002	-0.001	-0.002	-0.001	-0.002	-0.002	0.000	-0.001	0.000	-0.002	-0.002
	(2.23)**	(0.92)	(3.55)***	(3.19)***	(5.41)***	(1.17)	(0.38)	(2.37)**	(0.34)	(10.13)***	(5.52)***
Size (20-99 empl.)	0.025	0.089	0.010	0.022	0.046	-0.033	0.055	0.061	0.003	0.034	0.032
	(1.29)	(2.84)***	(0.46)	(1.21)	(2.54)**	(0.38)	(2.12)**	(2.60)***	(0.10)	(2.43)**	(1.83)*
Size (>=100 empl.)	0.078	0.125	0.164	0.110	0.187	0.222	0.239	0.147	0.062	0.059	0.059
	(1.57)	(2.27)**	(3.89)***	(3.26)***	(6.65)***	(1.62)	(4.87)***	(3.62)***	(1.25)	(2.52)**	(1.87)*
Agglomeration	-0.001	0.004	-0.000	0.000	-0.001	-0.002	0.000	0.000	-0.001	0.001	0.001
	(1.43)	(2.69)***	(0.30)	(1.84)*	(1.24)	(3.48)***	(0.19)	(0.15)	(2.49)**	(2.84)***	(1.72)*
Weak instrument diagnostic[a]											
Cragg-Donald Stat.	16.3	3.0	24.0	74.7	38.3	1.5	15.3	37.3	11.5	44.7	50.1
Observations	1928	494	3702	5638	3642	500	1661	2870	1474	5702	5988
Number of countries	52	28	62	76	69	9	53	67	54	49	50

Clustered z statistics (absolute value) at country level in parentheses
All regressions include country and sector fixed effects
The reference for size dummies is small size (less than 20 employees)
* significant at 10%; ** significant at 5%; *** significant at 1%
[a] Weak instruments diagnostic tests give partial and Shea partial R^2 between 0.04 and 0.10 and large F-statistics.
First-stage regressions (not reported for conciseness) are available upon request.

Appendix 3.12: Estimation with additional variables

	Dependent variable : FDI						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Telecom problems	-0.251	-0.278	-0.281	-0.284	-0.273	-0.270	-0.231
	(9.62)***	(9.80)***	(10.19)***	(10.22)***	(9.60)***	(9.62)***	(6.59)***
Informal finance	-0.001	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002
	(3.21)***	(3.03)***	(2.96)***	(2.81)***	(3.08)***	(2.85)***	(4.98)***
Skilled labor problems	-0.002	-0.018	-0.021	-0.017	-0.026	-0.025	-0.024
	(0.23)	(1.69)*	(1.94)*	(1.56)	(2.25)**	(2.16)**	(1.81)*
Crime and disorder	-0.022						
	(2.48)**						
Property right		0.005	0.005	0.004	0.006	0.005	0.009
		(0.64)	(0.66)	(0.59)	(0.76)	(0.70)	(0.85)
Age	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001
	(7.48)***	(6.45)***	(6.83)***	(6.84)***	(6.91)***	(6.85)***	(4.24)***
Size (20-99 empl.)	0.028	0.027	0.026	0.027	0.025	0.023	0.019
	(3.25)***	(2.72)***	(2.57)**	(2.66)***	(2.70)***	(2.44)**	(1.71)*
Size (>=100 empl.)	0.128	0.119	0.120	0.119	0.113	0.108	0.130
	(7.78)***	(6.42)***	(6.64)***	(6.84)***	(6.48)***	(6.37)***	(6.02)***
Agglomeration	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.33)	(0.20)	(0.24)	(0.22)	(0.19)	(0.19)	(0.80)
Labor regulation			0.005	0.012	0.003	0.006	0.010
			(0.44)	(0.90)	(0.20)	(0.41)	(0.54)
Corruption				-0.021	-0.031	-0.027	-0.031
				(2.24)**	(3.28)***	(2.76)***	(3.21)***
Custom and trade					0.042	0.048	0.035
					(4.72)***	(4.95)***	(3.28)***
Tax rates						-0.021	-0.015
						(2.19)**	(1.34)
Wage							-0.002
							(0.23)
Weak instrument diagnostic[a]							
Cragg-Donald Stat.	590.1	426.0	329.1	273.9	224.4	198.2	10.8
Observations	33604	23500	23130	22749	21170	21105	13576
Number of countries	77	55	55	55	55	55	51

Clustered z statistics (absolute value) at country level in parentheses
All regressions include country and sector fixed effects
The reference for size dummies is small size (less than 20 employees)
* significant at 10%; ** significant at 5%; *** significant at 1%
[a] Weak instruments diagnostic tests give partial and Shea partial R^2 between 0.08 and 0.12 and large F-statistics.
First-stage regressions (not reported for conciseness) are available upon request.

Appendix 3.13: African specificity

	Dependent variable : FDI					
	Sub-Saharan Africa			Other developing countries		
	(1)	(2)	(3)	(4)	(5)	(6)
Telecom problems	-0.238	-0.239	-0.224	-0.248	-0.248	-0.229
	(3.22)***	(3.26)***	(2.53)**	(8.54)***	(8.63)***	(7.86)***
Informal finance	-0.000			-0.001		
	(0.51)			(3.09)***		
Skilled labor problems	-0.019	-0.013	-0.014	0.001	0.006	-0.009
	(0.73)	(0.54)	(0.60)	(0.10)	(0.53)	(0.69)
Crime and disorder	-0.038	-0.034	-0.049	-0.020	-0.014	-0.018
	(1.71)*	(1.62)	(2.57)**	(2.11)**	(1.26)	(1.34)
Age	-0.001	-0.001	-0.001	-0.002	-0.002	-0.002
	(1.00)	(1.30)	(1.14)	(7.78)***	(7.82)***	(8.11)***
Size (20-99 employees)	0.065	0.064	0.058	0.022	0.023	0.022
	(2.12)**	(2.12)**	(1.55)	(2.57)**	(2.71)***	(2.58)***
Size (>=100 employees)	0.221	0.203	0.194	0.118	0.118	0.110
	(5.31)***	(4.93)***	(3.96)***	(6.58)***	(6.90)***	(6.68)***
Agglomeration	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(0.57)	(0.61)	(0.51)	(0.40)	(0.37)	(0.33)
Access to finance probl.		-0.042	-0.053		-0.027	-0.032
		(2.00)**	(2.23)**		(2.68)***	(3.03)***
Labor regulation			-0.039			0.014
			(1.02)			(0.92)
Corruption			0.028			-0.012
			(1.35)			(1.04)
Custom and trade			0.042			0.058
			(2.62)***			(5.22)***
Tax rates			0.001			-0.020
			(0.08)			(1.87)*
Weak instrument diagnostic[a]						
Cragg-Donald Stat.	73.4	75.3	28.5	497.0	489.6	220.2
Observations	5366	5366	4150	28238	28238	25861
Number of countries	23	23	22	54	54	54

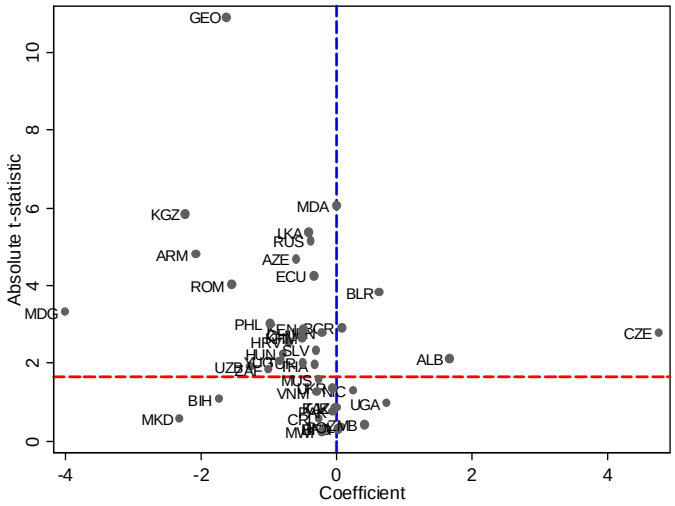
Clustered z statistics (absolute value) at country level in parentheses. All regressions include country and sector fixed effects. The reference for size dummies is small size (less than 20 employees). The results are confirmed by statistical test of the significance of the difference in the estimated coefficients between Sub-Sahara African countries and other developing countries. The African specificity is first confirmed by the introduction of a dummy variable in the full sample.

* significant at 10%; ** significant at 5%; *** significant at 1%

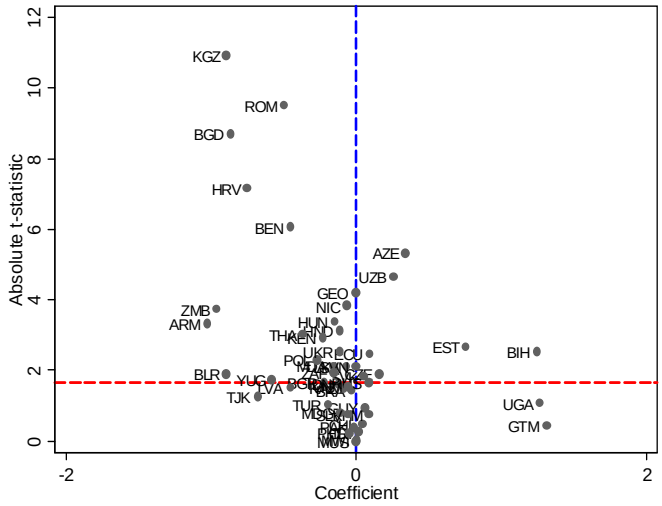
[a] Weak instruments diagnostic tests give partial and Shea partial R^2 between 0.07 and 0.12 and large F-statistics. First-stage regressions (not reported for conciseness) are available upon request.

Appendix 3.14: Heterogeneity in the impact of major structural problems

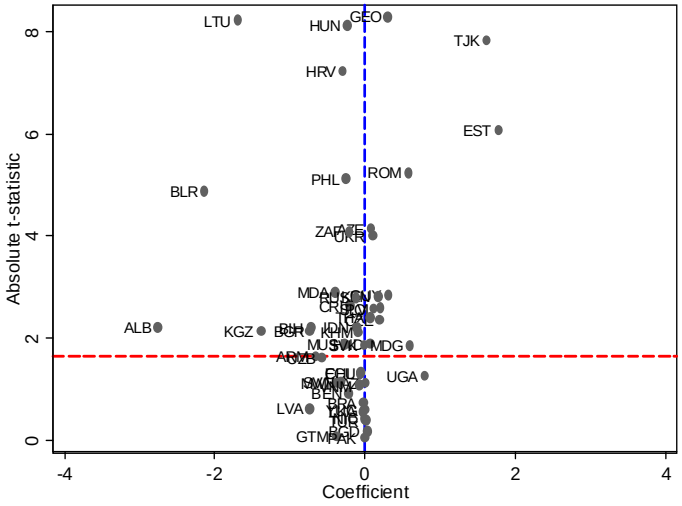
Telecom problems and FDI



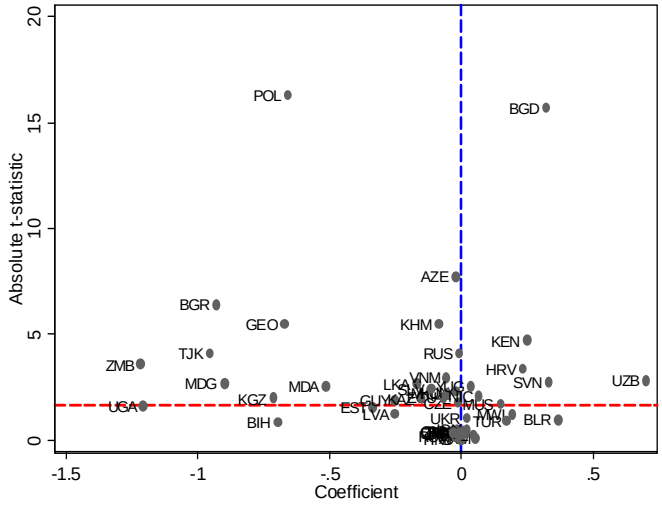
Informal finance and FDI



Corruption problems and FDI



Skilled labor problems and FDI



These graphs resume coefficients and t-statistics of country level estimations. Each point represents the effect of the structural factors (telecom problems, informal finance, corruption problems and skilled labor problems) on FDI for one country. Coefficients are reported on the horizontal axis and the absolute value of t-statistics on the vertical axis. All regressions have FDI variable as dependant variable and structural factors as explanatory variables. The regressions also include firm characteristics and other control variables and deal with endogeneity issue as regressions (3) and (6) of appendix 6 (graphics are country-level illustration of regression (3) and (6) of appendix 6). The horizontal dashed line t=1.64 indicates 10% significance level. The vertical dashed line indicates the null value of coefficient. The upper-left side of all graphs indicates countries for which structural factor constraints reduce significantly attractiveness for FDI.

Appendix 3.15: List of countries

Asia	Eastern and Central Europe	Latin America and Carribean	Sub-Saharan Africa
Bangladesh	Albania	Argentina	Angola
Cambodia	Armenia	Bolivia	Benin
Indonesia	Azerbaijan	Brazil	Botswana
Lebanon	Belarus	Chile	Burundi
Mongolia	Bosnia and Herzegovina	Colombia	Congo. Dem. Rep.
Pakistan	Bulgaria	Costa Rica	Eritrea
Philippines	Croatia	Ecuador	Ethiopia
Sri Lanka	Czech Republic	El Salvador	Gambia
Thailand	Estonia	Guatemala	Guinea-Bissau
Vietnam	Georgia	Guyana	Kenya
	Hungary	Honduras	Lesotho
	Kazakhstan	Mexico	Madagascar
	Kyrgyz Republic	Nicaragua	Malawi
	Latvia	Panama	Mali
	Lithuania	Paraguay	Mauritania
	Macedonia. FYR	Peru	Mauritius
	Moldova	Uruguay	Namibia
	Poland		Senegal
	Romania		South Africa
	Russian Federation		Swaziland
	Serbia and Montenegro		Tanzania
	Slovak Republic		Uganda
	Slovenia		Zambia
	Tajikistan		
	Turkey		
	Ukraine		
	Uzbekistan		

PART 2: CONSEQUENCES AND A POLICY RESPONSE TO PRIVATE CAPITAL FLOWS

Chapter 4:
Private Capital Inflows and the Real Exchange Rate in Developing Countries

1. Introduction

Policy makers often seek to attract external resources based on the premise that they will finance savings gaps and promote growth and economic development (Dornbusch, 1998). However, empirical evidence on the growth potential of capital account openness is mixed (Kose et al. 2006). Moreover, significant increases in capital inflows can increase the vulnerability of the financial system and provoke macroeconomic overheating. Lending booms, which often follow increased capital inflows, increase vulnerability in the financial system by exacerbating maturity mismatch between bank assets and their liabilities and in some cases the currency mismatch between the lending and the borrowing currency of the banks. These booms can also increase financial sector vulnerability through associated asset price bubbles. Macroeconomic overheating can be stimulated by accelerated economic growth and inflation, particularly the appreciation of the real exchange.

The subsequent loss of competitiveness caused by an appreciated real exchange rate is one of the main potential negative consequences associated with capital inflows, particularly large inflows (Edward, 1998). Under a flexible exchange rate regime, the real appreciation of the exchange rate is due to the appreciation of the nominal exchange rate. In the case of a fixed exchange rate, the real appreciation is due to higher inflation following the increase of the money supply. The appreciation of the real exchange rate jeopardizes export competitiveness, widens the current account deficit, and increases the vulnerability to a financial crisis. Significant appreciation of the real exchange rate could indeed lead to a drying up or a sudden stop of capital flows leading to a sharp adjustment of the current account. Beyond its negative effect on the investment, a significant appreciation of the real exchange rate could thus create major challenges for macroeconomic stability and management.

The sharp increase in external finance to developing countries, particularly private flows during the last decade and prior to the current financial crisis, sheds some

light on the transfer problem[42]. The spectacular rise in private flows was driven by the surge of foreign direct investment (FDI) and current private transfers (mainly remittances). While commercial bank loans constituted the main component of private capital flows to developing countries during the mid 1980s, foreign direct investment and remittances became the two major components, particularly in low-income countries[43]. These changes in the landscape of capital flows to developing countries raise the importance of reassessing the transfer problem with particular focus on private flows and their different components.

While most studies focus on the effect of aggregated or specific form of capital inflows on the real exchange rate, this chapter proposes a comprehensive analysis of the impact of different forms of private capital flows (FDI, portfolio investment, bank loans, and private transfers) on the real exchange rate. Based on a sample of 42 developing countries over the period 1980-2006, this chapter uses the new pooled mean group estimator that allows short-run heterogeneity while imposing long-run homogeneity of the real exchange rate determination across countries. The results show that the aggregated capital inflows as well as public and private flows appreciate the real exchange rate. Among private flows, portfolio investment has the highest appreciation effect on the real exchange rate, almost seven times the appreciation due to FDI or banks loans. Private transfers lead to the lowest appreciation of the real exchange rate.

Developing countries often use various policies to dampen the real appreciation of their exchange rate following episodes of capital inflows. These include macroeconomic policies such as sterilization, exchange rate flexibility, and fiscal tightening, as well as more structural policies, such as capital controls, trade liberalization, and better regulation and supervision of the financial system. While

[42] The transfer problem refers to the impact of the resources' inflows or outflows on the domestic economy -captures mainly through the real exchange rate.

[43] Portfolio investments have represented a significant part of private capital flows to emerging countries since the 1990s.

sterilization is the most used policy, fiscal tightening and exchange rate flexibility remain the most effective ones (IMF, 2007). This chapter uses, for the first time, a *de facto* measure of exchange rate flexibility to conclude that a higher flexibility of the exchange rate could effectively offset the real appreciation of the exchange rate stemming from capital inflows.

The chapter is organized as follows: Section 1 discusses the transfer problem and stresses the potential heterogeneity according to the type of capital flows. Section 2 reviews the main macroeconomic fundamentals explaining the real exchange rate. Section 3 describes the main trends and compositions of external financing to developing countries. The panel co-integration method (the pooled mean group estimator) and the data are discussed in sections 4 and 5, respectively. The empirical results are presented in the following sections. Based on a *de facto* measure of flexibility of the exchange rate, we assess how the real appreciation of the exchange rate due to capital inflows could be offset with higher flexibility of the exchange rate. The last section concludes.

2. The Transfer Problem

There is extensive literature on the determinants of the real exchange rate. In the case of developing countries, Edwards (1989), Hinkle and Montiel (1999), Edwards and Savastano (2000), and Maeso-Fernandez, Osbat, and Schnatz (2004) provide comprehensive surveys of the literature. A number of studies focus on the impact of capital flows on the real exchange rate, the so-called transfer problem. Capital inflows involve stronger demand for both tradables and non-tradables and lead to a higher relative price of non-tradables[44] and the appreciation of the real exchange rate. This is needed for domestic resources to be diverted toward production in the non-tradable sector in order to meet the increased demand. Lane and Milesi-Ferretti (2004) find that countries with net external liabilities have a more depreciated real exchange rate. Based on a sample of 48 industrial and emerging economies, Lee,

[44] The price of tradables is internationally determined.

Milesi-Ferretti, and Ricci (2008) show that higher net foreign assets appreciate the real exchange rate.

The impact of capital flows on the real exchange rate also depends on the form of the flows. Private flows are more directed to investment, increasing the productive capacity of the economy. However, public flows finance relatively more government consumption mainly in the non-tradable sector (a large part of the governments' budgets is for wages and purchases of domestic services). In developing countries, particularly in poor countries, consumption relies more on domestic goods, of which their supply capacity is limited. In contrast, the increase of investment may lead to higher imports and an improvement of the productive capacity. Capital inflows associated with higher consumption should have higher pressure on the relative price of domestic goods, leading to more appreciation of the real exchange rate compared to capital inflows financing investment growth[45]. Higher investments following increases in public flows could also lead to a misallocation of capital and low quality investments with no significant impact on the productive capacity.

Compared to borrowing from commercial banks, in general, FDI flows lead to less credit and money expansion since these flows are less (or shortly) intermediated into the local banking system. The inflation potential of FDI can thus be lower than that of commercial banks loans. FDI flows are related to investments with the purchases of new machineries and equipments that are imported. Higher import associated with FDI inflows does not suffer from the constraints in the supply capacity of the local economy and thus creates almost no appreciation effect. The spillover effects of FDI could also improve the local productive capacity through the transfer of technology and managerial know-how. Compared to bank lending and portfolio investment, FDI is a more stable capital flow. The appreciation of the real exchange rate due to FDI is lower than the real appreciation associated with the more volatile private flows not necessarily increasing the productive capacity, such as portfolio investments (Lartey, 2007). Portfolio investments are indeed speculative flows,

[45] The structure of the consumption also influences its effect on the real exchange rate. A larger part of traded goods in public or private consumption affects the real exchange rate differently.

looking for higher short-term yields. These flows could not be associated with an improvement of the productive capacity, creating short-term instability and macroeconomic overheating.

Remittances can have varying effects on the real exchange rate, depending on whether they are pro- or countercyclical. On one hand, remittances can act more as a buffer stock, helping to smooth consumption if they rise when the recipient economy suffers an economic downturn (Chami et al., 2005). In this case, remittances contribute to the stability of recipient economies by compensating for foreign exchange losses due to macroeconomic shocks. These countercyclical remittances have a limited appreciation effect on the real exchange rate. Remittances could, however be for investment purposes and pro-cyclical as other forms of foreign investment flows (FDI, portfolio investment, bank loans)[46]. Pro-cyclical remittances represent additional capital inflows and could exacerbate the macroeconomic overheating, leading to further appreciation of the real exchange rate. For instance, pro-cyclical remittances in the real estate sector could significantly increase input prices in the construction sector and appreciate the real exchange rate. However, if remittances are disproportionately devoted to spending on traded goods (for imported consumer durables, for instance), their effects on the real exchange rate tend to be weakened (Chami et al. 2008).

Empirical evidence on the specific impact of diverse forms of capital flows on the real exchange rate is particularly limited, except those focusing on official flows, FDI, or recently on remittances. These studies have mixed results.

[46] The theoretical determinants of remittances as indicated by Lucas and Stark (1985) in their seminal paper that lead to further debate are pure altruism, pure self-interest, and tempered altruism or enlightened self-interest. Under a pure altruism assumption, the income needs of migrants' family in home country drive remittances when remittances under pure self-interest remittances are driven by investment motive. The in-between case of tempered altruism or enlightened self-interest is a situation in which consumption and investment motives determine remittances.

A number of analyses highlight the fact that official flows are associated with the appreciation of the real exchange rate (Kasekende and Atingi-Ego, 1999; Bulir and Lane, 2002; Prati, et al., 2003; Lartey, 2007; Elbadawi et al., 2008). Other studies do not conclude to a real appreciation of the exchange rate due to public flows (Li and Rowe, 2007; Aiyar et al., 2007). Cerra et al. (2008), for instance find that inflows of grants lead to the appreciation of the real exchange rate if they are used to enhance productivity in the tradable sector. If grant flows are used to improve productive capacity in the non-tradable sector, the authors find evidence of real depreciation of the exchange rate.

The effect of private transfers or remittances on the appreciation of the real exchange rate is largely admitted but empirical results are more mixed (Chami et al., 2008). On the one hand, authors such as Bourdet and Falck (2003), Amuedo-Dorantes and Pozo (2004), Montiel (2006), and Saadi-Sedik and Petri (2006) find that remittance inflows appreciate the real exchange rate. On the other hand, Izquierdo and Montiel (2006) and Rajan and Subramanian (2005) do not conclude unanimously that remittances are associated with the appreciation of the real exchange rate.

Studies on the impact of other private flows on the real exchange rate are more limited and the results are also mixed. Athukorala and Rajapatirana (2003) conclude that FDI inflows lead to a depreciation of the real exchange rate while other private capital flows are associated with a real appreciation. However, Lartey (2007) finds that FDI appreciates the real exchange rate while the aggregate "other capital flows" does not affect the real exchange rate. Saborowski (2009) finds that capital inflows and particularly FDI lead to a real appreciation of the exchange rate in developing countries.

These studies focus on the impact of the aggregated capital or particular form of capital flows (grants, FDI, or remittances) on the real exchange rate and lead to very mixed conclusions. Hansen and Tarp (2000, 2001) explain divergences in the effect of capital flows on the real exchange rate through misspecification errors in the econometric model of some studies. These divergences could also be due to the

differences in sample, method, and period across studies. This chapter proposes a comprehensive analysis of the impact of different components of private flows (FDI, portfolio investment, bank loans, and private transfers) on the real exchange rate, while controlling for official flows. Most of the studies focus on a particular country or a group of countries by imposing the short-term and long-term homogeneity between countries. This chapter considers a sample of developing countries and applies a new panel co-integration method that imposes long-run homogeneity between countries while allowing the short-run dynamics to differ across countries.

3. External Financing to Developing Countries

The aggregated total capital flow is the sum of public and private flows from the *World Economic Outlook*. Private capital flows are the sum of four elements. These are the *Direct Investment in reporting economy from abroad (FDI)* including debt-creating liabilities to foreign direct investors and direct investment in the form of equity; *Portfolio Investment (PIL)* which is the sum of debt instruments issued by the domestic private sector (corporate bonds and other private debt securities) and foreign purchases of equities of domestic companies; *Current Private Transfers*[47] *(PRT)* and

[47] Remittances are not adequately defined in the balance of payments (BOP). Remittances are part of three items in the BOP with none of these items including exclusively remittances. We use private current transfers as a proxy for remittances following Dorsey et al. (2008). Workers' remittances account for three quarters of private transfers in the BOP for low income countries (Dorsey et al., 2008). The other items that include a small part of remittances (and are not represented in our proxy of remittances) are income credits or net income of the BOP that include compensation of employees. Another component of remittances included in the capital account is migrants' transfers. Since the BOP data disaggregate capital transfers only into debt forgiveness and other capital transfers, an estimation of migrants' transfers is very challenging. Private transfers could thus underestimate or overestimate the level of remittances according to the importance of employee compensation, migrants' transfers, and part of the private transfers that are not remittances. See Reinke (2007) and Dorsey et al. (2008) for a comprehensive analysis of measurement and definition issues of remittances using BOP data.

Liabilities to Foreign Bank (LFB)[48]. Public flows are the sum of *Official loans (OL)* and *Official current Transfers (OT)*. Official loans are the sum of official liabilities including the use of the IMF credits *(BFOLG)*, debt instruments, such as government bonds issued by the domestic public sector *(BFPLDG)*, and debt forgiveness in the capital account, including those granted by the IMF *(BKFO)*[49]. In order to get a more precise picture of the net resource that is effectively transferred in each country, the interest paid on the total debt *(DSI)* could be deduced from the official loans[50]. In the first part of the empirical analysis aiming to assess the composition effect of capital flows on the real exchange rate, we use the two definitions of public flows (considering or not considering the payment of interest on debt). The rest of the empirical analysis refers to the notion of net transfers on debt and considers public flows excluding the payment of interests on debt (Net total external financing).

$$Gross\ total\ external\ financing = \underbrace{FDI + PIL + LFB + PRT}_{Private\ flows} + \underbrace{\underbrace{BFOLG + BFPLDG + BKFO}_{Official\ Loans\ Net\ of\ Debt\ Forgiveness} + PUT}_{Public\ Flows}$$

$$Net\ total\ external\ financing = \underbrace{FDI + PIL + LFB + PRT}_{Private\ flows} + \underbrace{\underbrace{BFOLG + BFPLDG + BKFO - DSI}_{Net\ Transfers\ on\ Debt} + PUT}_{Public\ Flows}$$

[48] The total private flows also include other liabilities, in the form of other loans, currency and deposits which are on average null between 1990 and 2004 in our sample countries. These flows consist of net outflows and net inflows according to the countries and the years.

[49] Balance of payments data record debt forgiveness as equivalent to amortization in the financial account. The proxy "official loans" captures net lending without being a perfect proxy. Indeed, the *World Economic Outlook* data have a single entry for debt forgiveness that could apply for debt forgiveness on official loans or on commercial bank loans, for instance. Thus, netting the entire stock of debt forgiveness against official loans may overstate the net lending from official sources and understate net lending from other sources to the extent that debt forgiveness is also reflected in a reduction in commercial or portfolio investment debts (Dorsey et al. 2008).

[50] Items in the financial account measure net changes in stocks that could be due to new lending, amortization, and partly debt forgiveness.

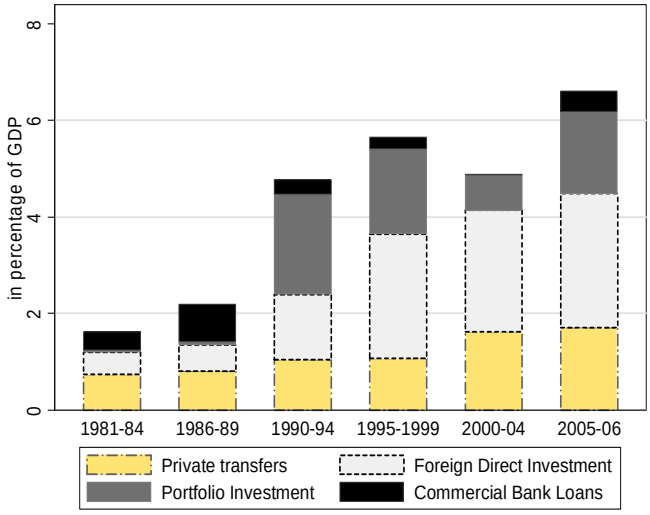
Based on the estimations of total external financing, the following section presents an overview of the trend and the composition of external financing. It is worth noting that the payment of interests on debts, which is represented as the other capital inflows for presentation purposes, constitute a capital outflow.

Figure 4.1: External financing in developing countries

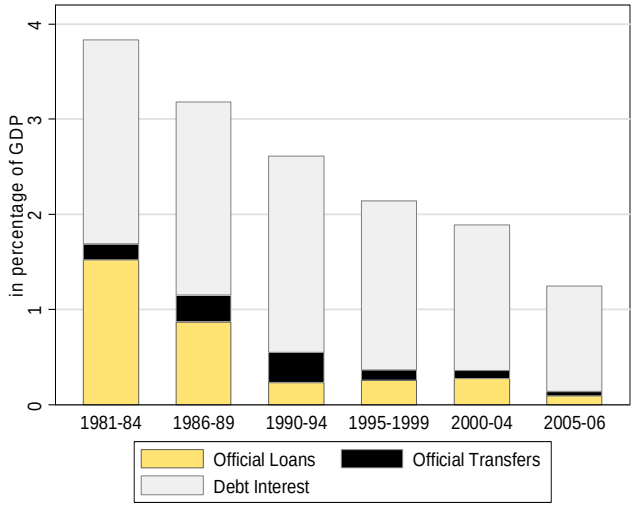
(sample of 42 countries included in the empirical analysis)

All countries

Private Capital Flows

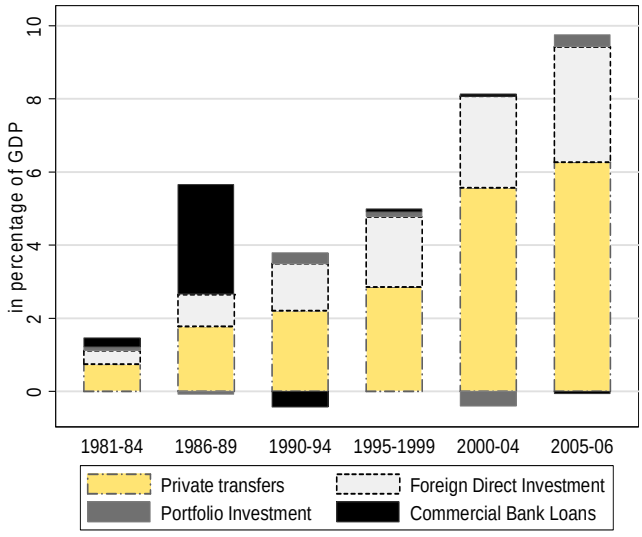


Public Capital Flows

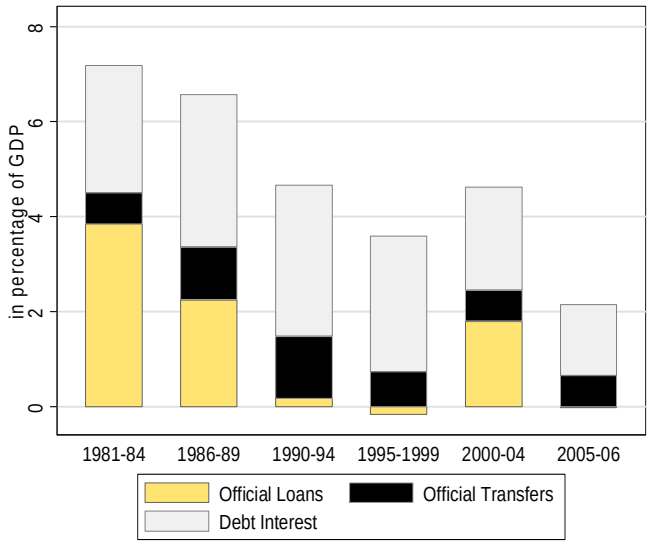


Lower income countries

Private Capital Flows



Public Capital Flows



Private capital flows have steadily increased since the 1980s, while public flows have been decreasing. From less than 2 percent of GDP in the beginning of the 1980s, private capital flows represented more than 6 percent of GDP during 2005-2006. The increase is even sharper in lower income countries, where private flows represent almost 10 percent of GDP during 2005-2006, far from their initial value of 1.5 percent of GDP in the beginning of the 1980s. Private capital flows are largely dominated by FDI, followed by private transfers (remittances), and portfolio investment during the more recent years. In lower income countries, the sharp increase in private flows is mainly due to the private transfers, which increased from less than 2 percent of GDP in the beginning of the 1980s to more than 6 percent of GDP during 2005-2006. FDI also increased from less than 1 percent of GDP in the 1980s, to almost 4 percent of GDP in lower income countries from 2005 to 2006[51].

A favorable macroeconomic environment and investment climate characterized by strong economic growth, moderate inflation, and better infrastructure quality facilitate productive activities attracting foreign investments (chapters 1 and 2). The factors driving the surge in remittances are more complex. The significant increase in remittances could be due to changes in the host or home countries economic environment, to reductions in transfer fees or simply to improvements in the quality of the data (Dorsey et al., 2008).

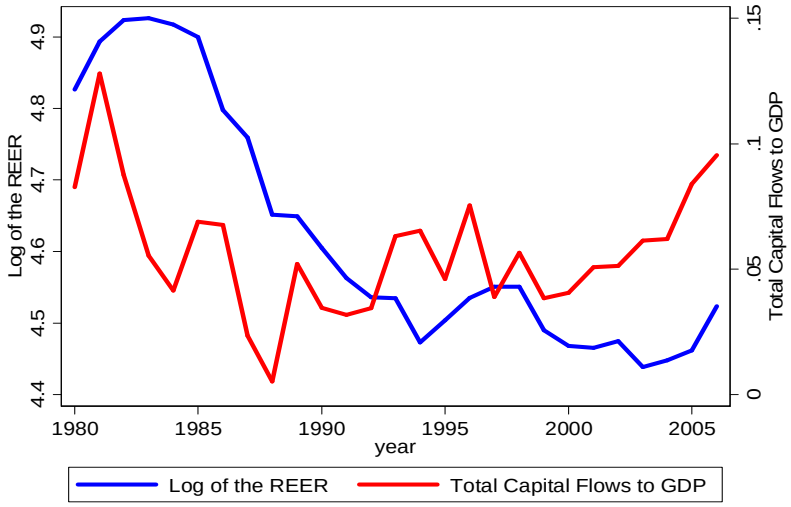
Commercial bank loans have become insignificant (particularly in lower income countries) since the 1990s and the associated financial crises. Although negligible for lower income countries, portfolio investments have been significant for emerging economies, particularly during the recent years (appendix 4). Public flows that were the main source of capital inflows to lower income countries have been surpassed by private flows. While public flows (grants and official loans) decreased sharply in all countries, there is an indication of a substitution of loans for grants in lower income countries, which is consistent with the donors' commitments.

[51] Using a sample of low-income countries, Dorsey et al. (2008) find the same trend and composition of external financing. The similarity is even stronger when the comparison is made with our sample of lower income countries.

Figure 4.2 describes the trends of the un-weighted means of the real exchange rate and the total capital inflows for the sample of 42 developing countries[52]. Each country's case (Senegal and Turkey in the main text and other selected countries in the appendix 4.5) provides more insight into trends of capital flows and REER between 1980 and 2006[53]. On average, periods of reduction (increase) of capital inflows are associated with depreciated (appreciated) real exchange rate. For instance, the significant increase in capital inflows in Turkey during the 2000s is associated with a sharp appreciation of the REER while the falling in capital inflows during the 1980s in Senegal is coupled with the depreciation of the REER.

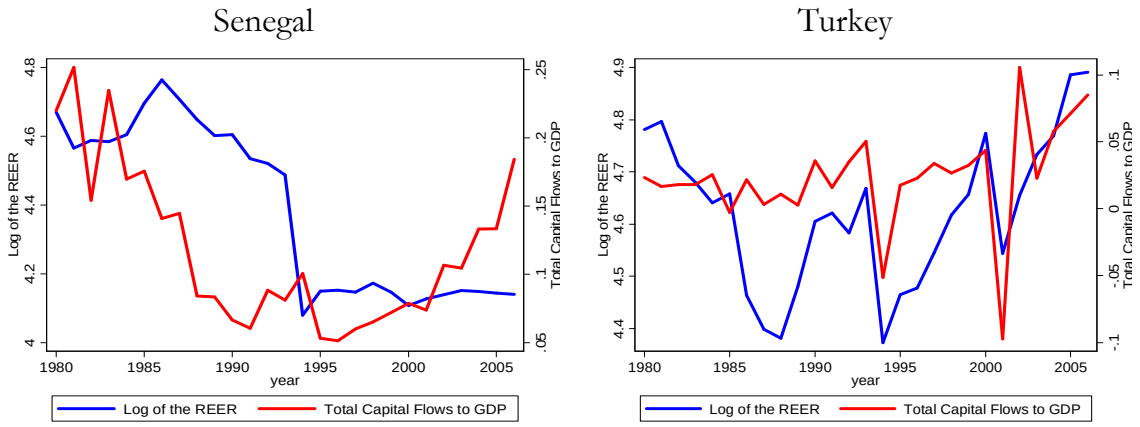
Figure 4.2: Real exchange rate and capital inflows

The Real Exchange Rate and Total Capital Inflows
(unweighted mean for a panel of 42 countries)



[52] Total capital flows are total external financing excluding the payment of interests on debt.

[53] The ten countries' cases reflect the situation well in the different categories of developing countries.



The following econometric analysis will help to get a stronger picture of the potential positive correlation between the REER and capital inflows as shown by the graphical analyses.

4. Econometric Methodology and Model

There are two common estimation methods used with dynamic panel data models. The first one consists of averaging separate estimations for each group in the panel. Pesaran and Smith (1995) show that this method (the Mean Group estimator) provides consistent estimates of the averages of the parameters. This method allows the parameters to be freely independent across groups and does not consider some potential homogeneity between groups. The second estimation method of dynamic panel models is the usual pooled method, including the random effects or fixed effects models or the GMM methods. These models constrain the parameters (coefficients and error variances) to be identical across groups, but the intercept is able to differ across groups. Pesaran, Shin, and Smith (1999) show that GMM estimations of dynamic panel models could lead to inconsistent and misleading long-term coefficients. This potential problem is exacerbated when the time dimension is large in the panel. Pesaran, Shin and Smith (1999) propose an intermediate estimator that allows the short-term parameters to differ across groups while imposing equality of the long-term coefficients across groups. The long-term movements of the real exchange rate and other macroeconomic fundamentals are expected to be identical across countries while short-term movements are expected to be influenced by country-specific characteristics. The null hypothesis of the

homogeneity in the long-term coefficients can be tested with a Hausman test. The dynamic heterogeneous panel model of Pesaran, Shin and Smith (1999) is an unrestricted error correction Autoregressive Distributed Lag (ARDL) *(p,q)* representation.

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i' x_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}' \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (1)$$

The cross section units (the countries) are denoted by $i = 1, 2, \ldots, N$ and $t = 1, 2, \ldots, T$ represent time periods. y_{it} is the dependent variable and x_{it} the matrix of regressors. μ_i denotes the fixed effects, ϕ_i the coefficient on the lagged dependent variable, β_i the vector of coefficients on the explanatory variables, λ_{ij} the coefficients on the lagged first-differences of the dependent variable, and δ_{ij} the coefficients on the first-differences of the explanatory variables and their lagged values. The disturbances ε_{it} are supposed to be normally and independently distributed across *i* and *t* with zero mean and variances $\sigma_i^2 > 0$.

With $\phi_i < 0$, there is a long-term relationship between y_{it} and x_{it} in the form :

$$y_{it} = \theta_i' x_{it} + \eta_{it} \qquad i=1, 2, \ldots, N \qquad t= 1, 2, \ldots, T \qquad (2)$$

$\theta_i' = -\frac{\beta_i'}{\phi_i}$ represents the long-term coefficient and the error terms of the long-term relationship (η_{it}) are stationary.

Considering the long-term relationship, equation *(1)* can be written as

$$\Delta y_{it} = \phi_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}' \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (3)$$

The error correction term $\eta_{i,t-1}$ is derived from the long-term equation *(2)* and the associated coefficient (ϕ_i) measures the speed of adjustment to the long-run equilibrium.

By allowing the short-term coefficients, the intercepts, and the error variances to differ across groups, but constraining long-term coefficients to be identical ($\theta_i' = \theta$), the pooled mean group estimator of Pesaran, Shin, and Smith (1999) derives the parameters with the maximum likelihood technique. With the pooled likelihood estimators defined as $\hat{\phi}_i$, $\hat{\beta}_i$, $\hat{\lambda}_{ij}$, $\hat{\delta}_{ij}$, and $\hat{\theta}$, the pooled mean group estimators are given by :

$$\hat{\phi}_{PMG} = \frac{\sum_{i=1}^{N} \hat{\phi}_i}{N}, \quad \hat{\beta}_{PMG} = \frac{\sum_{i=1}^{N} \hat{\beta}_i}{N} \tag{4}$$

$$\hat{\lambda}_{jPMG} = \frac{\sum_{i=1}^{N} \hat{\lambda}_{ij}}{N}, \text{ j =1, …, } p\text{-1}, \quad \hat{\delta}_{jPMG} = \frac{\sum_{i=1}^{N} \hat{\delta}_{ij}}{N}, \text{ j=0, …, } q\text{-1} \tag{5}$$

$$\hat{\theta}_{PMG} = \hat{\theta} \tag{6}$$

More specifically, the long-term relationship between the real exchange rate and macroeconomic fundamentals is given by:

$$REER_{it} = \theta_0 + \theta_1 TOT_{it} + \theta_2 PROD_{it} + \theta_3 TRADE_{it} + \theta_4 CAPITAL_{it} + \nu_{it} \tag{7}$$

$i = 1, 2, \ldots, N \qquad t = 1, 2, \ldots, T$

Where $REER_{it}$ is the real effective exchange rate, TOT_{it} represents the term of trade, $TRADE_{it}$ is the ratio of export and import over the GDP, $PROD_{it}$ reflects the productivity gap, and $CAPITAL_{it}$ is the ratio of total external financing over the GDP.

The Real Effective Exchange Rate (REER) in the analysis is a CPI-based real exchange rate defined as a weighted geometric mean of bilateral nominal exchange rate and consumer price indices. An increase of the REER indicates an appreciation and, hence, a potential loss of competitiveness. The REER of a country *i* is defined as:

$$REER_i = NEER_i \times \prod_{j=1}^{10} \left(\frac{CPI_i}{CPI_j} \right)^{wj}$$

$$NEER_i = \prod_{j=1}^{10} \left(NBER \right)^{wj}$$

With $REER_i$, $NEER_i$, and $NBER_i$ representing the real effective exchange rate, the nominal effective exchange rate, and the nominal bilateral exchange rate of country *i* respectively. CPI_i and CPI_j denote the consumer price index of country *i* and country *j*. *wj* is the weight of the *j-th* partner in the bilateral trade of the country *i*. The weights represent for each country *i*, the average share of trade with its main partners *j* during the period 1999-2003. The analysis considers the ten main trade partners and excludes oil-exporting countries (those for which petroleum related products represent at least 50% of the exports). Weights are calculated at the end of the period of observations in order to focus on the competitiveness diagnosis for the most recent years. This choice allows taking the significant increase of the weight in international trade of some large emerging countries into account, such as China, India or Brazil during the recent years. The increasing importance of these large emerging market trade partners is even more pronounced for other developing countries.

The productivity gap aims at capturing the potential Balassa-Samuelson effect. It is defined as a country's GDP per capita relative to the weighted average of its trading partners' GDP per capita. The weights of the partner countries are similar to those used in the construction of the REER. The so-called Ballasa-Samuelson effect assumes that the productivity in tradable sectors grows faster than in non-tradable sectors. This results in higher wages in the tradable sectors that spill over to the non-tradable sectors and place upward pressure on wages. Since prices in tradable sectors are internationally determined and homogeneous across countries, higher wages in the non-tradable sectors result in a higher relative price of non-tradables. This implies an increase in domestic inflation and an appreciation of the REER. A rise in the *terms of trade* is expected to appreciate the equilibrium *REER* to the extent that it improves the trade balance; the income effect dominating the substitution

effect. *Trade openness* also affects the prices of non-tradables through an income effect and a substitution effect. Higher restriction on trade has a negative effect on the tradables' prices through the income effect and a positive effect through the substitution effect. The income effect is less likely to dominate the substitution effect (Edwards, 1988). It is thus expected that restricted trade will exert downward pressure on the relative price of tradable to non-tradable goods, thereby leading to an appreciation of the equilibrium REER.

Assuming that all variables are *I(1)* and co-integrated, v_{it} is supposed to be *I(0)* for all *i* and is independently distributed across *t*. With a maximum of one lag[54] for all variables, the equilibrium error correction representation of the autoregressive distributed lag, ARDL(1, 1, 1, 1, 1) model is:

$$\begin{aligned}\Delta REER_{it} = \phi_i \left[REER_{i,t-1} - \theta_0 - \theta_1 TOT_{it} - \theta_2 PROD_{it} - \theta_3 TRADE_{it} - \theta_4 CAPITAL_{it} \right] \\ - \delta_{1i}\Delta TOT_{it} - \delta_{2i}\Delta PROD_{it} - \delta_{3i}\Delta TRADE_{it} - \delta_{4i}\Delta CAPITAL_{it} + \varepsilon_{it}\end{aligned} \qquad (8)$$

The coefficients of primary interest are the θ since the study focus on long-run relationships. In the first part of the analysis, the interest variable *(CAPITAL)* will be disaggregated into various components to assess the differential impact of each type of capital flows on the real exchange rate. The second part of the study, aiming to assess the effectiveness of the exchange rate policy as a hedge against real appreciation due to capital inflow, will add exchange rate flexibility variable and its cross term (with capital variable) in the error correction equilibrium representation: equation (8).

The dataset is based on annual observation for 42 developing countries over the period 1980-2006. While data availability guides the choice of the countries, the sample gives a representative coverage of developing countries by including

[54] The choice of the lag length is based on the empirical literature on the determinants of the real exchange rate and confirmed by the Akaike Information Criterion (AIC).

emerging and lower income countries as well as countries from the main developing regions[55]. Appendix 4.1 summarizes the definitions and sources of all variables.

5. Econometric Results

Before presenting the results of the co-integration analysis, we first validate that the variables are non-stationary and co-integrated. Appendix 6 presents the unit root tests on the real exchange rate and other variables. These tests confirm that almost all variables are non-stationary and could be considered as integrated of order one. As a second step, we test the existence of a long-term relationship between the variables of the baseline specifications. Various co-integration tests (Panel rho, Panel ADF, Group rho, Group ADF, etc.) following Pedroni (2000) confirm the existence of a co-integrating vector in all cases.

Using the pooled mean group estimator, table 4.1 presents the long-run coefficients, which are of interest in this chapter. It is worth noting that with the co-integration analysis, the potential endogeneity between the real exchange rate and the fundamentals does not affect the long-run coefficients. The adjustment term is always negative and significant, indicating the absence of an omitted variable bias. The Hausman tests confirm that the restriction of long-term homogeneity of coefficients cannot be rejected at the 1 percent significance level. This indicates the preference of the pooled mean group estimator over the mean group estimator that supposes heterogeneity in short-term and long-term coefficients.

First, the estimations present the impact of the aggregated capital inflows on the real exchange rate. In a second step, the impacts of public and private flows on the real exchange rate are separately estimated, followed by the effects of different components of private capital flows on the real exchange rate.

[55] Appendix 2 gives the list of the countries include in the analysis.

Table 4.1: Composition of Capital Inflows and Real Exchange Rate

	Dependent variable: Log Real Effective Exchange Rate			
	(1)	*(2)*	*(3)*	*(4)*
EC	*-0.165*	*-0.171*	-0.122	*-0.139*
	*(5.38)***	*(5.55)***	(4.82)***	*(4.91)***
Log(Productivity)	0.052	0.050	0.271	0.085
	(1.03)	(0.97)	(4.03)***	(1.50)
Log(Term of Trade)	0.370	0.323	0.761	0.365
	(8.41)***	(7.91)***	(14.43)***	(8.08)***
Log(Trade)	-0.081	-0.074	-0.163	-0.099
	(2.56)**	(2.37)**	(3.62)***	(2.80)***
Total Capital	0.130			
	(2.00)**			
Private Capital		0.181	2.071	
		(2.87)***	(7.07)***	
Public Capital[+]		0.852	1.580	1.597
		(3.45)***	(3.84)***	(4.99)***
Debt interest Payment			-2.490	
			(2.82)***	
FDI				1.233
				(2.07)**
Portfolio Inv.				7.844
				(7.03)***
Private transfers				0.274
				(2.61)***
Bank Loans				0.917
				(2.05)**
Hausman Test	4.28	*3.58*	*3.92*	1.47
[p-value]	*[0.37]*	*[0.61]*	*[0.69]*	*[0.99]*
Co-integration Test				
Kao Test	4.16	-4.21	-5.01	3.71
	[0.00]	*[0.00]*	*[0.00]*	*[0.00]*
Panel rho	4.16	5.38	4.65	
	[0.00]	*[0.00]*	*[0.00]*	
Panel ADF	1.33	1.40	-13.6	
	[0.16]	*[0.15]*	*[0.00]*	
Group rho	6.09	7.45	6.14	
	[0.00]	*[0.00]*	*[0.00]*	
Group ADF	3.79	3.50	-11.23	
	[0.00]	*[0.00]*	*[0.00]*	
Observations	1073	1073	1073	1073
No. of countries	42	42	42	42
Log-likelihood	1344.24	1378.62	1378.62	1464.31

EC refers to the error correction term. Only long-run coefficients are reported.

* significant at 10%; ** significant at 5%; *** significant at 1%

All specifications include a maximum of one lag. Numbers in parentheses are t-statistics. Numbers in brackets for the Hausman and co-integration tests are p-values. For Co-integration tests, the null hypothesis is the absence of co-integration. The null hypothesis for the Hausman test is the restriction of long-term coefficients homogeneity.

[+] Except in regression 3, interest payments are excluded from public flows.

The estimation results show that capital inflows appreciate the real effective exchange rate (REER). A one-percentage point increase in total capital inflows to GDP implies a 0.13 percent appreciation of the real exchange rate. The real appreciation of the exchange rate due to public flows is statistically higher compared to the real appreciation effect of private flows (column 2 in table 1). This result could suggest that private flows are more employed for investments that increase the productive capacity of the economy, while public flows are relatively more directed to government consumption, mainly in the non-tradable sector. The difference between the real appreciation effect of public and private flows is, however not robust to an alternative specification that includes the payment of debt interests as a control variable[56]. With this alternative specification (column 3 in table 1), the appreciation effect of private and public capital flows are not statistically different. Both types of flows lead to the appreciation of the REER of about the same magnitude. Indeed, a one-percentage point increase in private and public capital flows lead to an appreciation of the REER of 2.1 percent and 1.6 percent respectively. As expected, the payments of interest on debt have a significant depreciation effect on the REER.

The last column of table 4.1 presents the impact of the different components of private capital flows on the REER. Public flows still have a significant appreciation effect on the REER. With respect to private flows, portfolio investments lead to the highest level of real appreciation of the exchange rate. The highest level of appreciation from portfolio investments is statistically significant when compared to the effect of the other private flows (FDI, private transfers, and bank loans) on the REER. A one-percentage point increase of portfolio investments to GDP is associated with a 7.8 percent appreciation of the REER. Compared to the other private flows, portfolio investments are more volatile and speculative flows, which are not generally associated with an increase of productive capacity.

[56] Payment of the interests on debts was deduced from public flows in the preceding estimations.

Following portfolio investments, FDI inflows appreciate the REER. However, the real appreciation stemming from FDI is statistically lower, almost 7 times smaller than the real appreciation induces by portfolio investments. Contrary to portfolio investments, FDI are more stable flows and increase the productive capacity through technology and know-how transfers. FDI are primarily for investment purposes and could lead to a higher import of new machineries and equipments with limited impact on the real exchange rate.

Loans from commercial banks also appreciate the REER significantly. The size of this appreciation is statistically similar to the real appreciation due to FDI. A one-percentage point increase in FDI or banks loans leads to an appreciation of the REER of about 1 percent. To illustrate the results, an increase of the ratio of FDI to GDP of about 4 percentage points as experienced by Ghana or Turkey between 2002 and 2006 would appreciate the real exchange rate by around 5 percent. One could expect a higher appreciation effect from banks loans, since these flows are more intermediated through the local banking system. The results suggest that bank loans could be more directed to investment financing like FDI, and lead to the improvement of the productive capacity. In this context, the inflation potential of bank loans could be similar to that of FDI, even though spillover effects are not associated with bank loans.

Private transfers appear to have the lowest appreciation effect on the real exchange rate. Indeed, a one-percentage point increase in private transfers leads to a 0.3 percent appreciation of the REER. An increase between 3 and 4 percentage points of the ratio of private transfers to the GDP, as observed in Nicaragua and Senegal between 2002 and 2006, would appreciate the REER by only almost one percent. This result could justify more counter-cyclical remittances against the pro-cyclical hypothesis. By helping households to smooth their consumption during hard times, remittances contribute to the stability of economy by avoiding a sharp depreciation of the exchange rate that could follow the losses of foreign exchange during a macroeconomic shock. In this context, the appreciation effect of remittance flows is limited. Remittances could also be disproportionally used for the purchase of

imported goods -consumers durables- and thus have a limited impact on the long-term equilibrium exchange rate (Chami et al., 2008).

With respect to the other macroeconomic fundamentals, terms of trade and trade openness are significant with the expected sign. A ten percent increase of the terms of trade appreciates the real exchange rate by almost 4 percent. More liberalized trade is associated with a depreciation of the real exchange rate. An increase of trade openness by ten percent leads to a real depreciation of the exchange rate of about 1 percent. These results are similar to those in the empirical literature (Chen and Rogoff, 2003; Cashin, Cépedes, and Sahay, 2004; Ricci, Milesi-Feretti, and Lee, 2008; Saborowski, 2009). The Balassa Samuelson effect, captured by the relative GDP per capita, is not always significant, although it has the expected sign. This could be due to the fact that the widely used GDP per capita is a poor proxy for the Balassa-Samuelson effect. The results are not significantly different for lower incomes countries (appendix 7).

The speed of the adjustment, reflected by the coefficient of convergence is about -0.2. The movements of the REER within a year correct about a fifth of the gap between the REER and the equilibrium REER (as determined by the fundamentals). Therefore, the half-life of a REER deviation from the long-term equilibrium value is about 3 years.

6. Exchange Rate Flexibility and the Appreciation of the Real Exchange Rate

Capital inflows could finance a growing current account deficit or contribute to reserve accumulation. With low accumulation of reserves, a large current account deficit during an episode of capital inflows could become a problem once inflows slowdown or reverse. A sudden and unexpected slowdown of capital inflows could necessitate a sharp reduction of the current account deficit and trigger a financial crisis. Secondly, capital inflows can facilitate macroeconomic overheating and a loss of competitiveness due to the appreciation of the real exchange rate. Authorities often seek to avoid or limit the appreciation of the real exchange rate with various

policies. Exchange rate flexibility is one of the main policy responses that countries could implement to manage capital inflows and avoid a real appreciation of their exchange rate. The following section discusses and tests the effectiveness of this policy response[57].

Independent of the foreign exchange regime, capital inflows associated with higher expenditure and a deficit of the current account increase the demand of money. In the presence of a fixed exchange rate, authorities' interventions to maintain the parity can lead to the accumulation of reserves and an increase in the supply of money. This creates the potential for macroeconomic overheating and vulnerability in the financial system. In poor countries with limited productive capacity, the increase in demand following the higher supply of money leads to inflation once excess capacity is absorbed. Under a free-floating exchange rate regime and no government intervention, capital inflows and the associated increase in money demand lead to the appreciation of the nominal exchange rate with no impact on international reserves and the money supply. In countries with an intermediate exchange regime, authorities aim for a specific level of the nominal exchange rate and the monetary aggregate. In this context, reserve accumulation is a policy instrument. Maintaining a certain level of nominal exchange rate with authorities' intervention through higher reserves accumulation leads to lower pressure on the nominal exchange rate and potentially higher inflation. In contrast, small-scale interventions of authorities with lower reserve accumulation can lead to higher pressure on the nominal exchange rate and lower inflation[58]. Exchange rate

[57] The policy responses to the real appreciation of the exchange rate include fiscal policy, sterilization policy, capital control policy, and trade liberalization. These additional policies do not fall under the scope of this chapter, which focuses on the flexibility of the exchange rate.

[58] This analysis supposes that most of the capital inflows are spent locally. If the major part of capital inflows were used for import purposes (for instance new machineries and equipments), a large increase in capital inflows would have little effect on the real exchange rate. That could be the case in relatively poor developing countries receiving foreign investment for the exploitation of natural resources.

flexibility ensures a degree of autonomy of the monetary policy from the capital inflows. By introducing uncertainty with a two-way risk, higher flexibility of the exchange rate could discourage short-term speculative flows and reduce the vulnerability of the financial system, particularly when their supervision and regulation are poor (Calvo, Leiderman, and Reinhart, 1996; Lopez-Mejia, 1999). Based on cross-sectional regressions in emerging countries, a recent study of the IMF (World Economic Outlook, 2007) fails to show that countries with more rigid exchange rate have a lower appreciation of their real exchange rate during episodes of capital inflows. Using a dynamic GMM model, Saborowski (2009) concludes that countries with a more flexible exchange rate regime (following the exchange rate regime classification of the IMF) have a lower impact of FDI flows on their real exchange rate.

In this study, we use a *de facto* measure of exchange rate flexibility. We approximate the flexibility of the exchange rate by an index based on the idea of the Exchange Market Pressure (EMP). The degree of the EMP is derived from a relationship between the nominal exchange rate and the relative level of foreign reserves[59].

$$EMP_1 = \%\Delta e_{i,t} / (\%\Delta e_{i,t} + \Delta f_{i,t})$$

$\Delta e_{i,t} = abs\left(\frac{er_{i,t} - er_{i,t-1}}{er_{i,t-1}}\right)$ $er_{i,t}$ is the bilateral nominal exchange rate of country *i* currency with the US dollar during year *t* and *abs* denotes the absolute value. $\%\Delta e_{i,t}$ represents the relative variation of the nominal exchange rate $(\Delta e_{i,t})$ expressed in percentage.

$\Delta f_{i,t} = \frac{abs\left(RES_{i,t} - RES_{i,t-1}\right)}{MB_{i,t-1}}$ $RES_{i,t}$ represents reserve assets and $MB_{i,t}$ the monetary base in country *i* during year *t*.

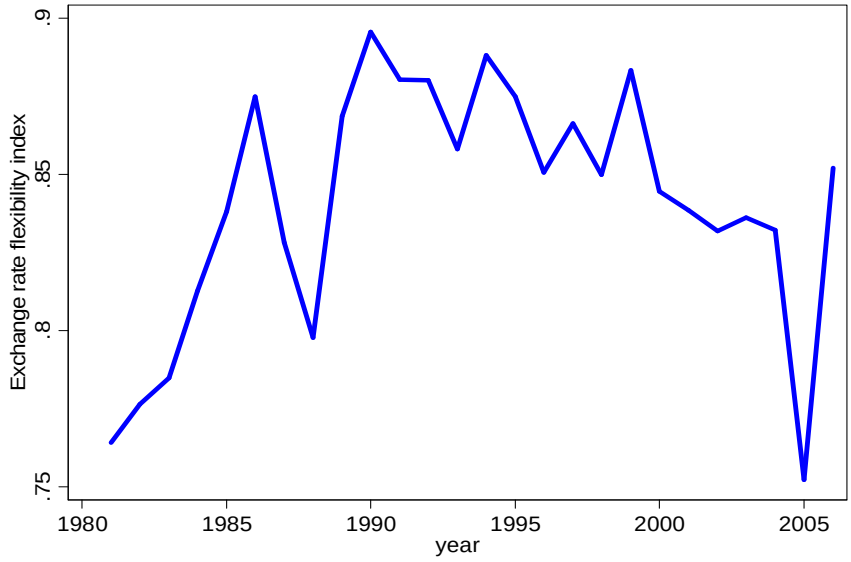
[59] For more details on the theoretical and practical issues of the EMP indices, see Girton and Roper (1977), Tanner (2001), Pentecost et al. (2001), Guimaeres and Karacadag (2004), Cavoli and Rajan (2007), World Economic Outlook (2007).

In a hypothetical case of pure floating system with no intervention on reserves ($\Delta f = 0$), the EMP index is equal to one reflecting the maximum flexibility of the exchange rate that is allowed to float freely. Changes in the EMP index reflect only changes in the exchange rate. In the case of hard peg, the exchange rate is constant ($\Delta e = 0$) and the EMP index is equal to zero. Changes in the index reflect only changes in reserves through monetary authorities' interventions. In intermediate cases, a low value of the EMP index indicates less exchange rate flexibility or higher level of intervention on the foreign exchange market. Higher volatility of foreign reserves reduces the EMP. This suggests that the monetary authorities are using foreign reserves to limit the variation of the nominal exchange rate[60]. An alternative definition of the EMP index is $EMP_2 = \Delta e_{i,t} - \Delta f_{i,t}$.

During previous episodes of capital inflows (before the debt crisis and before the Asian crisis), the high flexibility of the exchange rate reflected large current account deficits (figure 3). The recent wave of capital inflows starting in the beginning of the 2000s is however associated with a lowering of the exchange rate flexibility, particularly in 2005, reflecting policy intervention with reserves accumulation (figure 4.3).

[60] Changes in reserves could also be due to valuation changes and not to policy intervention. Availability of data on the currency composition of reserves could help to address this caveat.

Figure 4.3: Index of Exchange Rate Flexibility



Using the index of flexibility of the exchange rate based on the concept of the exchange market pressure, this study shows that higher flexibility of the exchange rate helps to dampen the appreciation of the REER stemming from capital inflows. In countries with a less rigid *de facto* exchange rate regime, capital inflows appreciate the real exchange rate less strongly. This result is also robust for lower income countries (table 2).

Table 4.2: Capital Inflows, Exchange Rate Flexibility and the Real Exchange Rate

	Dependent variable: Log Real Effective Exchange Rate	
	Total sample	***Lower income countries***
EC	*-0.239*	*-0.278*
	*(5.32)****	*(3.32)****
Log(Productivity)	0.088	0.075
	(2.71)***	(2.51)**
Log(Term of Trade)	0.189	0.280
	(4.75)***	(6.89)***
Log(Trade)	-0.034	0.004
	(1.67)*	(0.24)
Total Capital	1.802	1.286
	(3.13)***	(2.36)**
Exchange Market Pressure (EMP_1)	-0.727	0.158
	(8.20)***	(1.15)
EMP_1 x Total Capital	-1.666	-1.193
	(2.87)***	(2.18)**
Hausman Test	1.23	1.58
[p-value]	*[0.97]*	*[0.95]*
Co-integration Test		
Kao Test	*-5.00*	*-0.96*
	[0.00]	*[0.17]*
Panel rho	*10.3*	*6.90*
	[0.00]	*[0.00]*
Panel ADF	*2.65*	*-3.99*
	[0.01]	*[0.00]*
Group rho	*12.4*	*8.55*
	[0.00]	*[0.00]*
Group ADF	*3.99*	*-1.56*
	[0.00]	*[0.12]*
Observations	932	510
No. of countries	42	23
Log-likelihood	1480.75	793.24

EC refers to the error correction term.
All specifications include a maximum of one lag.
* significant at 10%; ** significant at 5%; *** significant at 1%
Numbers in parentheses are t-statistics. Numbers in brackets for the Hausman and the co-integration tests are p-values. For Co-integration tests, the null hypothesis is the absence of co-integration. The null hypothesis for the Hausman test is the restriction of long-term coefficient homogeneity.
Lower income countries group includes: Benin, Burkina Faso, Bangladesh, Bolivia, Côte d'Ivoire, Cameroon, Republic of Congo, Ecuador, Gabon, Ghana, Guinea, Sri Lanka, Lesotho, Morocco, Mali, Mozambique, Mauritania, Namibia, Nigeria, Nicaragua, Philippines, Paraguay, Senegal.

Following the Asian financial crisis, developing countries, particularly in Asia have started to accumulate significant reserves for precautionary motives. We control for these changes in reserves that do not reflect the management of the volatility of the exchange rate. We thus defined an additional measure of flexibility of the exchange rate using the difference between the level of reserves and their trend value obtained with the Hodrick-Prescott method. This allows for the capture of the change in reserves that are only due to the management of the volatility of the exchange rate and not to other objectives, such as savings for precautionary reasons. The index of flexibility of the exchange rate is also defined using the nominal effective exchange rate vis-à-vis each country's top-ten trading partners, similarly to the definition of the real effective exchange rate. The results are robust with these alternative definitions of the flexibility of the exchange rate (appendix 8). The flexibility of the exchange rate helps thus to dampen the real appreciation effect of capital inflows in all cases.

7. Conclusion

This chapter has analyzed the impact of capital inflows and different components of private capital inflows on the real exchange rate and has assessed the potential role of the exchange rate flexibility as a hedge against the real appreciation.

Using the pooled mean group estimator (Pesaran, 1999) that considers long-term homogeneity in the behavior of the real exchange rate across countries, while allowing for short-term heterogeneous shocks, the chapter shows that private and public capital inflows appreciate the real exchange rate. Disaggregating private capital inflows show that the appreciation effect of private flows differs according to the type of flows. More volatile portfolio investments have the highest appreciation effect on the real exchange rate. Following portfolio investments, FDI and bank loans significantly appreciate the real exchange rate. Since these flows are potentially related to an increase in the productive capacity, the real appreciation associated with FDI or bank loans is almost seven times lower than the real appreciation due to portfolio investments. Private transfers (mainly remittances) are the flows with the lowest appreciation effect on the real exchange rate. This suggests more

counter-cyclical remittances against the pro-cyclical hypothesis. Private transfers could help countries to offset the real depreciation of their exchange rate during periods of economic slowdown.

Countries often implement various policies to reduce or avoid the loss of competitiveness associated with the appreciation of the real exchange rate following capital inflows. This chapter assesses the effectiveness of the policy of exchange rate flexibility, one of the main macroeconomic tools available to countries when facing significant capital inflows. Using a *de facto* measure of exchange rate flexibility, we find that allowing greater flexibility of the exchange rate helps to dampen the real appreciation of the exchange rate due to capital inflows.

When implementing policies to attract capital flows, developing countries should consider the potential to destabilize macroeconomic management with a significant appreciation of the real exchange rate. Particular interest should be given to short-term flows, such as portfolio investments, given their considerable real appreciation effect compared to the other types of capital flows. Resisting nominal appreciation of the exchange rate through intervention in the foreign exchange market does not prove to be a useful method for avoiding a real appreciation of the exchange rate. Countries facing episodes of capital inflows should thus allow some flexibility of their exchange rate. This would help to cure the appreciation of the real exchange rate stemming from capital inflows and avoid a significant loss of competitiveness.

Appendices

Appendix 4.1: List, definition and sources of variables

Variable	Definition	Source
Log(REER)	Logarithm of Real Effective Exchange Rate, CPI base	CERDI
Log(Productivity)	Logarithm of GDP per capita relative to trading partners.	CERDI
Log(Term of Trade)	Logarithm of the term of trade	World Economic Outlook (WEO)
Log(Trade)	Logarithm of (Export + Import)/GDP	World Development Indicators (WDI)
Total Capital	Total external financing to GDP	World Economic Outlook (WEO)
Private Capital	Private capital inflows to GDP	World Economic Outlook (WEO)
Public Capital	Public capital inflows to GDP	World Economic Outlook (WEO)
FDI	Foreign Direct Investment to GDP	World Economic Outlook (WEO)
Portfolio Inv.	Portfolio Investment to GDP	World Economic Outlook (WEO)
Private Transfers	Private transfers to GDP	World Economic Outlook (WEO)
Bank Loans	Banks loans to GDP	World Economic Outlook (WEO)
Debt Interest	Payment of debt interest to GDP	World Economic Outlook (WEO)
Exchange Market Pressure	Index of flexibility of the exchange rate	World Economic Outlook (WEO) and World Development Indicators (WDI)

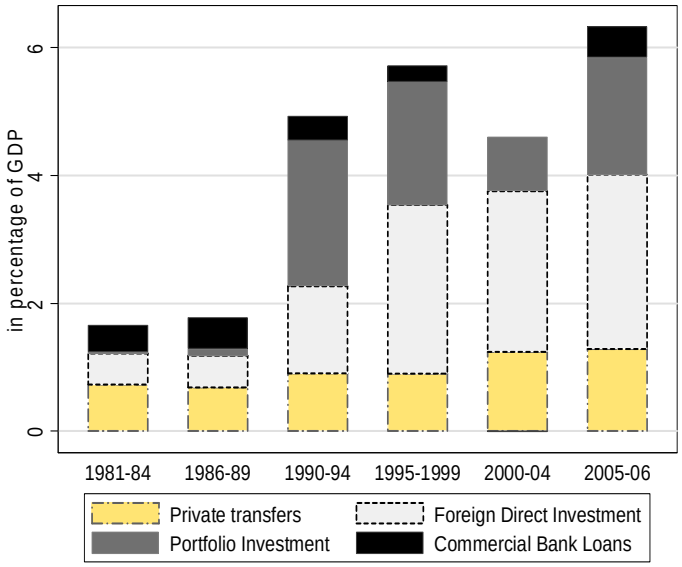
Appendix 4.2: List of countries

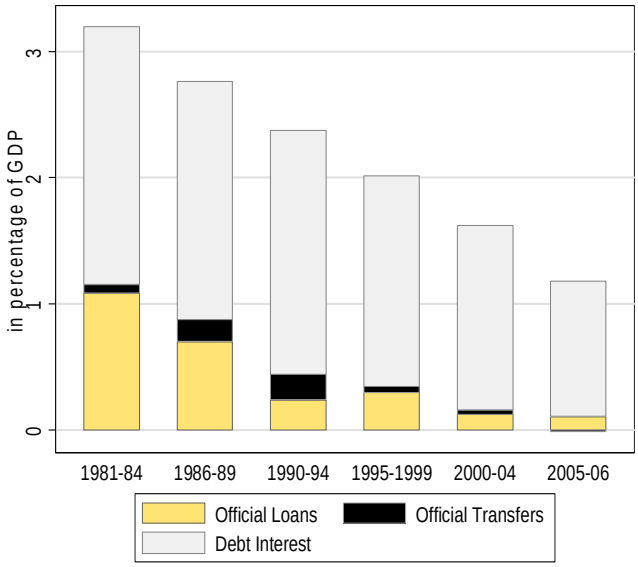
Benin, Burkina Faso, Bangladesh, Bolivia, Brazil, China, Côte d'Ivoire, Cameroon, Republic of Congo, Colombia, Costa Rica, Dominican Republic, Algeria, Ecuador, Egypt, Gabon, Ghana, Guinea, Guatemala, India, Sri Lanka, Lesotho, Morocco, Mali, Mozambique, Mauritania, Mauritius, Malaysia, Namibia, Nigeria, Nicaragua, Oman, Panama, Peru, Philippines, Paraguay, Senegal, El Salvador, Thailand, Turkey, Uruguay, South Africa.

Appendix 4.3: Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Log(REER)	1117	4,621	0,409	3,169	7,634
Log(Productivity)	1117	-2,256	0,923	-4,211	-0,172
Log(Term of Trade)	1117	4,637	0,248	3,590	5,947
Log(Trade)	1117	-0,550	0,545	-2,761	0,828
Total Capital Flows to GDP	1117	0,055	0,197	-3,080	1,592
Total Private Flows to GDP	1117	0,051	0,108	-0,286	1,230
FDI to GDP	1117	0,015	0,024	-0,090	0,435
Portfolio Investment to GDP	1117	0,007	0,060	-0,316	1,179
Private Transfers to GDP	1117	0,025	0,078	-0,114	0,973
Bank Loans to GDP	1117	0,005	0,036	-0,236	0,521
Total Public Flows to GDP	1117	0,024	0,116	-0,347	1,475
Debt Interest	1117	0,024	0,025	-0,038	0,215
Exchange Market Pressure	979	0,845	0,338	0	1

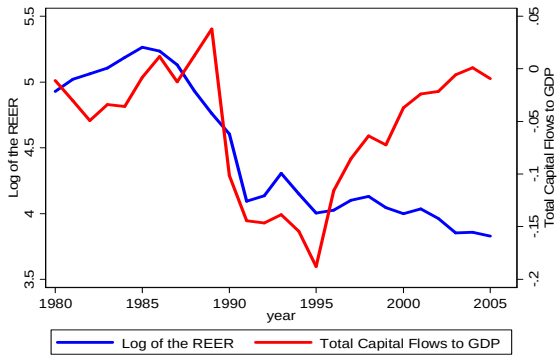
Appendix 4.4: External financing in upper income countries



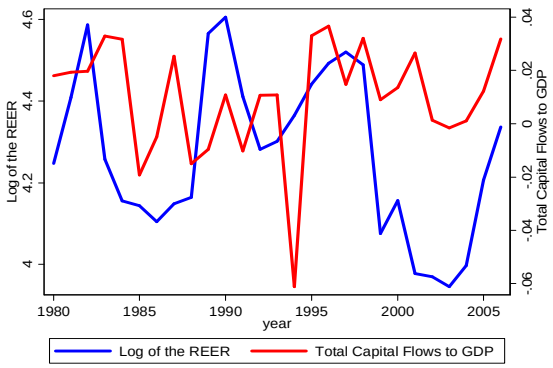


Appendix 4.5: Real exchange rate and capital inflows (selected countries)

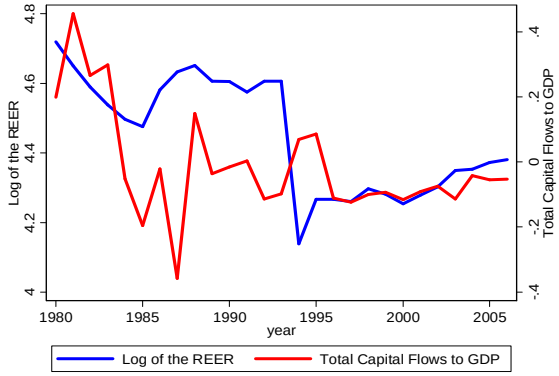
Algeria



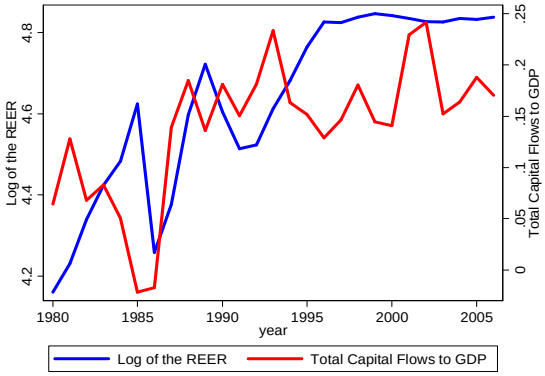
Brazil



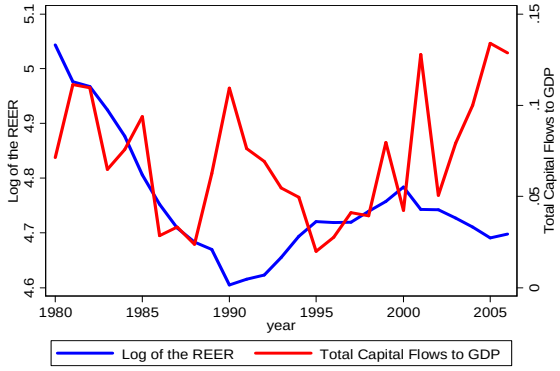
Côte d'Ivoire



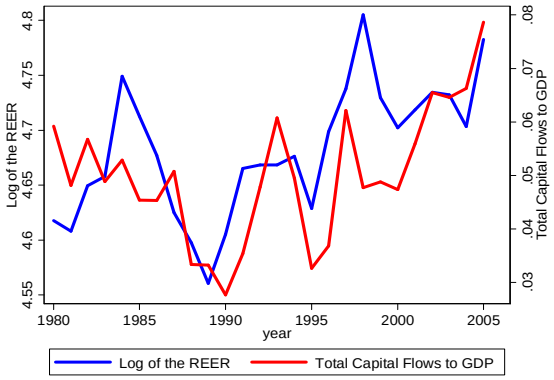
El Salvador



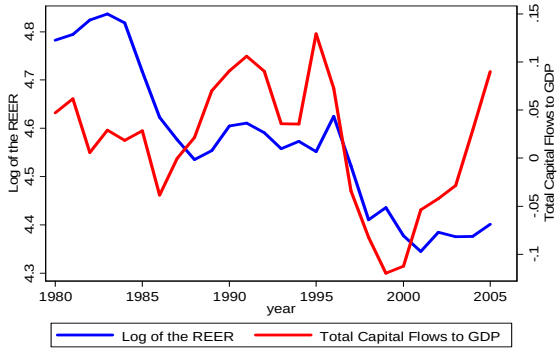
Morocco



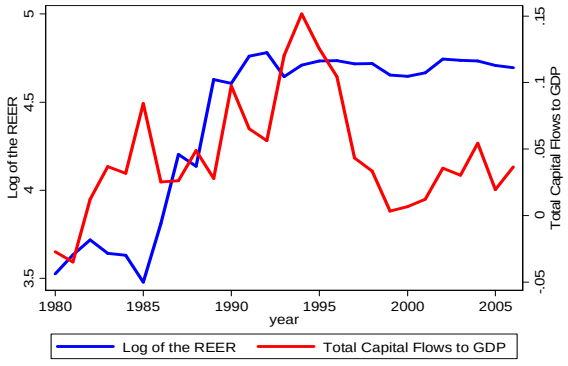
Sri Lanka



Thailand



Peru



Appendix 4.6: Unit root tests

	Level		*First Difference*	
	ADF	IPS	ADF	IPS
REER	0.83	0.12	0.00	0.00
Productivity	0.32	0.42	0.00	0.00
Term of Trade	0.19	0.99	0.00	0.00
Trade	0.05	0.12	0.00	0.00
Total Capital	0.05	0.06	0.00	0.00
Private Capital	0.03	0.05	0.00	0.00
Public Capital	0.00	0.01	0.00	0.00
FDI	0.53	0.60	0.00	0.00
Portfolio Inv.	0.21	0.91	0.00	0.00
Private transfers	0.98	0.96	0.00	0.00
Bank Loans	0.00	0.00	0.00	0.00

Number reported here are p-value. The Null hypothesis is the presence of unit root.
IPS refers to Im, Peseran, and Shin

Appendix 4.7: Composition of capital inflows and real exchange rate (Lower Income Countries)

	Dependent variable: Log Real Effective Exchange Rate		
	(1)	(2)	(3)
EC	*-0.175* *(3.93)***	*-0.189* *(4.14)***	*-0.131* *(3.36)***
Log(Productivity)	0.105 (1.73)*	0.107 (1.85)*	0.050 (0.65)
Log(Term of Trade)	0.429 (9.00)***	0.336 (8.05)***	0.391 (7.42)***
Log(Trade)	-0.089 (1.87)*	-0.070 (1.72)*	-0.133 (2.69)***
Total Capital	0.167 (2.35)**		
Private Capital		0.254 (3.16)***	
Public Capital		1.266 (4.03)***	1.902 (5.40)***
FDI			1.250 (1.98)**
Portfolio Inv.			9.818 (7.18)***
Private transfers			0.324 (2.52)**
Bank Loans			13.126 (4.00)***
Hausman Test	0.19	3.80	4.03
p-value	*[0.98]*	*[0.58]*	*[0.85]*
Observations	588	588	588
No. of countries	23	23	23
Log-likelihood	668.97	686.66	726.56

EC refers to the error correction term.
All specifications include a maximum of one lag.
* significant at 10%; ** significant at 5%; *** significant at 1%
Lower income countries group includes: Benin, Burkina Faso, Bangladesh, Bolivia, Côte d'Ivoire, Cameroon, Republic of Congo, Ecuador, Gabon, Ghana, Guinea, Sri Lanka, Lesotho, Morocco, Mali, Mozambique, Mauritania, Namibia, Nigeria, Nicaragua, Philippines, Paraguay, Senegal.

Appendix 4.8: Robustness check: Exchange rate flexibility and real exchange rate

	Dependent variable: Log Real Effective Exchange Rate			
	Δe – Δf	***Filtered Reserve (HP, λ=100)***	***Filtered Reserve (HP, λ=10)***	***Nominal Effective Exchange Rate***
	(1)	(2)	(3)	(4)
EC	*-0.072*	*-0.214*	*-0.214*	*-0.185*
	*(5.22)***	*(6.23)***	*(6.23)***	*(5.63)***
Log(Productivity)	0.034	0.217	0.217	0.112
	(0.34)	(4.27)***	(4.27)***	(2.04)**
Log(Term of Trade)	-0.296	0.342	0.342	0.374
	(2.02)**	(8.48)***	(8.48)***	(8.04)***
Log(Trade)	-0.395	-0.096	-0.096	-0.056
	(8.29)***	(2.90)***	(2.90)***	(1.58)
Total Capital	0.715	2.840	2.840	1.196
	(3.58)***	(4.24)***	(4.24)***	(2.09)**
Exchange Market Pressure (EMP_2)	-2.749			
	(7.52)***			
Total Capital x EMP_2	-15.438			
	(5.92)***			
Exchange Market Pressure (EMP_1)		-0.616		
		(6.44)***		
Total Capital x EMP_1		-2.613		
		(3.89)***		
Exchange Market Pressure (EMP_1)			-0.616	
			(6.44)***	
Total Capital x EMP_1			-2.614	
			(3.89)***	
Exchange Market Pressure (EMP_1)				0.026
				(0.25)
Total Capital x EMP_1				-1.019
				(1.78)*
Hausman Test	2.07	26.8	26.8	5.58
p-value	*[0.91]*	*[0.01]*	*[0.01]*	*[0.47]*
Observations	823	823	823	827
No. of countries	34	34	34	34
Log-likelihood	1333.91	1193.85	1193.85	1201.49

EC refers to the error correction term.
All specifications include a maximum of one lag.
* significant at 10%; ** significant at 5%; *** significant at 1%

Chapter 5:
Investment Climate, Foreign Ownership, and Aggregate Productivity

1. Introduction

The abundant recent literature on economic growth embedded a renewed interest in the differences in productivity among countries and regions. Productivity, in the form of technical progress and technical efficiency, is a key source of long-run economic growth and international convergence of economies. The importance of Total Factor Productivity (TFP) in explaining differences in countries' incomes levels and performances is indeed well demonstrated and agreed upon (Klenow and Rodriguez-Clare, 1997; Hall et Jones, 1999; Easterly and Levine, 2001). These TFP differences have been attributed to technological differences across countries (Howitt, 2000; Klenow and Rodriguez-Clare, 2005). A recent literature explains productivity differences between countries by resources misallocation across firms (Banerjee and Duflo, 2006; Bartelsman, Haltiwanger and Scarpetta, 2006; Hsieh and Klenow, 2007; Restuccia and Rogerson, 2007; Foster, Haltiwanger, and Syverson, 2008). Within narrowly defined sectors, dispersion in firms' TFP may reflect distortions that prevent resources from being better allocated -to firms that are more productive. Distortions in developed countries are mostly from adjustment cost and cost in reallocating factors of production (Hopenhayn, 1992 and Hammermesh and Pfann, 1996). For developing countries, investment climate variables such as infrastructure, finance, human capital, institutions, or regulatory policies are important source of distortions and could be addressed with appropriate policies and reforms (Doing Business, 2006). These distortions negatively affect countries' aggregate productivity and efficiency.

Productivity in the manufacturing industry is central to international competitiveness. This competitiveness objective can be achieved by several non-exclusive means, including an exchange rate policy that modifies relative prices, or by specific actions in relation to productive performance. While changes in the exchange rate are mainly determined by the macroeconomic context, firm productivity is influenced by not only public, but also private factors, reflecting their own organizational efficiency, external economic or institutional environments.

Over the last decade, thanks to the extension of national microeconomic databases, an applied literature has emerged, emphasizing firm productivity determinants including those traditionally considered as invariant within a country. This new branch of the literature has explored the question of differences in the investment climate as a major factor contributing to differences in productivity[61]. In Dollar, Hallward-Driemeier and Mengistae (2005) for instance, the heterogeneity of the investment climate variables was tested and not rejected for firms of four developing countries in Asia. In the same vein, the World Bank's *World Development report* (2005) argues that Indian firms in states with poor investment climate have 40% lower productivity than those where this climate is good. The surveys on the Investment Climate Assessment (ICA) have been a good expression of the World Bank's concern to highlight this diversity across countries and across domestic regions. Indeed, ICA datasets are now available for a wide range of countries and present the valuable advantage to refer to a standardized questionnaire allowing international comparisons.

Investment climate is defined by the World Bank as the policy, institutional and regulatory environment in which firms operate (World Bank, 2005). Key factors affecting the investment climate are corruption, taxation, regulatory framework, legal environment, quality of infrastructure, availability and cost of finance, quality of human capital, and technological and innovation support. For instance, countries where the property rights are secure and the infrastructure and finance services are well developed are considered as having a good investment climate, which in turn reduces the cost of doing business and leads to higher and more certain returns on investment. The forward-looking nature of investment underlines the importance of a stable and secure environment. Deficiencies in the investment climate are also seen as constituting barriers to entry, exit, and competition.

[61] See at the macroeconomic level Bosworth and Collins (2003), Djankov and al. (2002), Hall and Jones (1999) Haltiwanger (2002), He et al. (2003), Loaya, Ociedo and Serven (2004), OECD (2001), Rodrik, Subramanian (2004), McMillan (1998 and 2004), World Bank (2003, 2004), Frankel (2002), and Rodrik (1999). See also Bastos and Nasir (2004), Dollar and al. (2005), Eifert and al. (2005), and Escribano and Gasch (2005) for results on firms' performances at the microeconomic level.

Our study is devoted to the exploitation of ICA datasets for the manufacturing sector in five developing countries over the mid 2000s. The data set we use come from the pooling of five ICA surveys, giving 4385 firms for which a stochastic frontier model can be estimated. These five countries are considered at the moment the survey was implemented with only few variations across them as the year in parenthesis may demonstrate: Brazil (2003), Morocco (2004), Pakistan (2002), South Africa (2003), Vietnam (2005). The objective of this chapter is threefold:

The aim of the chapter is to explain firms' productivity by their business environment, evaluate why foreign firms are more productive than local companies, and assess vertical spillovers from foreign to local companies. With particular attention to the foreign ownership variable, the chapter first explains firms' technical inefficiencies with different groups of variables reflecting organizational as well as economic and institutional factors. The results show that investment climate variables matter for firms' productivity and foreign firms are significantly more productive compared to local companies. Secondly, the chapter proposes and tests for the first time, the better investment climate faced by foreign as major factors explaining their higher productivity compared to local companies. Efficiency gains prove to be significant if all firms operate in the investment climate faced by foreign companies. Lastly, a new firm-level measure of vertical spillovers is introduced to highlight vertical (backward) spillovers for local companies supplying multinational firms with intermediate inputs.

The chapter is organised as follows. Section 2 analyzes the theoretical relationship between several dimensions of firms' economic and institutional environment, particularly the presence of foreign ownership in firms' capital and their productive performances. In section 3, we describe the methodology we use to analyze relative productive efficiency. This section introduces different concepts of firm-level productivity and discusses the advantages and limits of the different measures. The stochastic frontier analyses (SFA) incorporating exogenous determinants of technical inefficiency are preferred to the early two-stage procedure, where predicted values of technical efficiency is regressed upon a vector of potential

determinants. The methodological section extends the benchmarking procedure to appraise the productivity gains proceeding from firm projections in "best operational environments" within the country. . Section 4 briefly presents the investment climate (*ICA*) surveys data and summarizes their main limitations. In section 5 we comment on the empirical results, and analyze potential externalities for local firms in doing business with multinational companies located in the country. Section 6 concludes.

2. Investment Climate, Foreign Ownership, and Productivity

Firm productivity depends on a wide range of factors. In the Global Competitiveness Report (2007), macroeconomic competitiveness is perceived as the set of institutions, policies, and factors that determine the level of productivity of a country. A similar definition can be retained in a microeconomic perspective. The World Bank uses this distinction in the *Investment Climate Assessment (ICA)* surveys by referring to the external economic and institutional environment on the one hand and firm specific factors on the other hand.

2.1. The external economic environment and productivity

Within a manufacturing sector, it is generally considered that macroeconomic policies have a similar impact across organisations producing homogenous goods. International trade and exchange rate policies are exogenous parameters and they are supposed to affect the activity of all entrepreneurs in the same way. However, adding *political economy* to the equation, discrimination among producers may exist. Different treatments may legally apply to firms through taxes and subsidies, according to firm size, the year of creation or the regional place where they stand, and particularly whether the firms are local or foreign-owned. Moreover, the quality of roads, transport, telecommunication and power provision may vary a lot, even

within a single country. The ICA questionnaires appraise what these constraints are and the magnitude of their severity.

Unreliable public provision of infrastructure may lead to investments that prove to be costly for private manufacturing producers. Infrastructure deficiencies constitute an important constraint to private sector development in developing countries (World Bank, 1994). By increasing transaction costs, telecommunications obstacles, transport failures and power outages increase the distortions in the economy and the misallocation of resources. Transport or telecommunication failures for example will increase the cost for suppliers to connect with their clients. Infrastructure is considered, as well, as a complementary factor to other production inputs. In particular, infrastructure stimulates private productivity by raising the profitability of the investments[62]. Furthermore, infrastructure also increases firms' productive performances by generating externalities across firms, industries, and regions[63].

Access to finance is also an important aspect of the business environment and allows firms to finance more investment projects, which leads to better productivity through higher capitalistic intensity and technical progress embodied in the new equipments. Besides, financial development has a positive effect on productivity because of better selection of investment projects and higher technological specialization through diversification of risk. A developed financial system creates more profitable investment opportunities by mobilizing and allocating resources to the most profitable projects (Levine, 1997).

Human capital is also at the origin of positive externalities[64]. Because skilled workers are better at dealing with changes, a skilled workforce is essential for firms to manage new technologies that require a more efficient organizational know-how

[62] Aschauer (1989), Argimon et al., (1997), Barro (1990), Blejer and Kahn (1984), Murphy, Shleifer, and Vishny (1989).

[63] For spatial externalities, see Holtz-Eakin and Schwartz (1995).

[64] Lucas (1988), Psacharopoulos (1988), and Mankiw, Romer and Weil (1992).

(Acemoglu and Shimer, 1999). New technologies generally involve significant organizational changes, which are better handled by a skilled workforce (Bresnahan, Brynjolfsson and Hitt, 2002). Human capital also gives to enterprises the opportunity to expand or enter new markets.

Competition is also an important channel that may affect firm-level productivity. When producing for external markets, competition is a permanent challenge, hence the higher the rate of the production that is exported, the higher the productive performance. The situation is quite different when production is dedicated to domestic clients and may benefit from high levels of trade protection. In this case, the stimulating strength of the market will mainly depend on domestic competition.

2.2. The institutional environment and productivity

Effective institutions do matter. They give the rules of the economic game, shape the activity and have a strong bearing on the organisation of production as well as investment decisions. Institutional environment illustrates the capacity of the government to provide an investment-friendly environment and reliable conditions to the private sector. Corruption is seen as having an adverse effect on firms' productive performances. This fact is well documented and often considered as one of the major constraints facing enterprises in the developing world (World Bank, 2005). Corruption increases costs, as well as uncertainties about the timing and effects of the application of government regulations (Tanzi and Davooli, 1997). Although government regulations and taxation are reasonable and warranted in order to protect the general public and to generate revenues to finance the delivery of public services and infrastructures, over-regulation and over-taxation deter productive performances by raising business start-up and firms' operating costs. Unofficial and private payments or benefits to public officials in order to get advantages in the applications of governments' laws or to avoid government biding decisions and regulations decrease the aggregate productivity by increasing economic distortions and the misallocation of resources across firms in the economy. The inefficiency of government in delivering public services (utilities,

security, etc.) and the time spent by managers in dealing with government regulation requirements (customs, licenses and registrations) affect firms by increasing their allocative inefficiency.

It is understood that governments play a key role in providing public goods and formal rules such as laws that delineate property rights or the judicial institutions that enforce these rights. However, through the agency relationships, those who represent governments and public bureaus have also been known to be a potential source of increasing transaction costs. Potential arbitrariness takes many forms. The standard ICA questionnaire stresses this *political economy* dimension through a wide range of items, such as state power and red tape of public administrations, corruption, protection of property rights, and the extent of government regulation. As The *World Development report* (2005) pointed out, a single national law can be applied differently within a country. The time to transfer property title in Brazil varies from 15 days in Brasilia to 65 days in Salvador. Even within a single location, the same conditions can affect firms differently across activities and across their ownership status.

Governance exerts a strong influence on the investment climate. On the empirical side, several studies have related economic performances to different measures of governance[65]. The role of security of property rights is one of the best documented and supported by the data[66]. Some authors have also tested the role of corruption[67]

[65] Acemoglu, Johnson, and Robinson (2001); Easterly and Levine (2003); Hall and Jones (1999); Knack and Keefer (1995); Rodrik, Subramanian, and Trebbi (2002).

[66] Easterly and Levine (2003), Knack and Keefer (1995), North (1990), Rodrik, Subramanian and Trebbi (2002), and Saleh (2004). Acemoglu, Johnson and Robinson (2001), Calderon and Chong (2000), and Mijiyawa (2008) in the context of growth.

[67] Mauro (1995); Gupta, Davooli and Alonso-Terme (2002); Mo (2001); Tanzi and Davooli (1997).

and, to a lesser extent, regulation,[68] and bureaucratic quality[69]. More recently, the literature has evaluated firm performance and its determinants using enterprises survey data[70]. Still quite new, this approach aims at strengthening the institutional literature by providing microeconomic foundations.

2.3. Foreign ownership, investment climate, and productivity

Beyond their macroeconomic advantages in terms of financing current account deficits or contributing to accumulate foreign reserves, policy makers often seek to attract foreign firms to benefit from their expected positive externalities with productivity spillovers from foreign companies to local firms. These spillovers could be in form of transfers of new technologies, management methods, products, and production processes. Positive spillovers will only occur if foreign firms are superior to the local ones in terms of productivity performances or technological knowledge. Domestic firms could thus learn from foreign companies by observation, by doing business with them, or through labor turnover. In the literature on international economics, a large number of theoretical and empirical analyses have concluded that foreign firms are more productive compared to their local counterparts. In their theoretical models, Helpman, Melitz, and Yeaple (2004) have predicted that only the most productive firms become multinational companies.

One can reasonably consider that foreign companies or their participation as shareholders to the capital of a domestic firm are potentially correlated with more efficient productive practices. They also allow saving on the fixed costs of producing technological innovations as well as on the marginal cost of their replication in the domestic environment. Foreign firms can also be seen as an

[68] Kerr (2002); Hernando and Soto (2000).

[69] Evans and Rauch (2000).

[70] Bastos and Nasir (2004); Dollar and al. (2005, 2006); Eifert and al. (2005); Escribano and Gasch (2005).

instrument to lowering the fixed costs and the transaction costs associated with the development of external networks that help the export behavior. External markets are more competitive than the domestic ones and as such, they stimulate cost minimization behaviors. Foreign firms could also update their production process by using foreign expertise and finance -that are not easily available for domestic firms- in presence of local constraints such as electricity problems. However, foreign firms could be less efficient compared to local companies since they do not know specific characteristics of the local markets. In the case of underdeveloped financial markets and an economy that is not sufficiently market-oriented, the impact of foreign investments on productivity could be limited.

Empirical results provide rather mixed evidence on the topic. Early evidences on spillovers that focus on intra-industry (horizontal) spillovers highlight positive correlation between foreign presence and firm performances[71]. The positive correlation between foreign firms and productivity in aggregated cross-sectional analyses could arise because foreign firms are more productive, as explained above and this affects local firms' performances after the transfer of ownership. The positive correlation could also be because foreign owners simply acquire the best domestic firms. This is a major shortcoming in cross sectional studies since multinational firms tend to be concentrated in specific sectors. Evidences of horizontal spillovers with firm-level studies are much more mixed. In the case of developing countries[72], Khawar (2003) finds that foreign firms are more productive than local enterprises in Mexico but the author does not find evidence of positive spillovers from foreign to domestic firms. Using panel data from manufacturing industries in China, Liu (2002) also finds a positive effect of FDI on domestic firms. By contrast, Haddad and Harison (1993) and Aitken and Harrison (1999) find evidence of negative spillovers associated with FDI respectively in Morocco and in

[71] See Blomström (1989) for a review.

[72] In the case of developed countries, the positive impact of foreign ownership on firms' performances have been highlighted by a number of authors including Goethals and Ooghe (1997), Alan and Steve (2005), Piscitello and Rabbiosi (2005), Temouri et al. (2008).

Venezuela. According to Aitken and Harrison (1999), this negative impact is due to the competition effect from foreign firms, forcing local firms to produce smaller output at higher cost that offset the positive impact of technology transfer with FDI. In a study on Bulgaria, Hungary, and Poland, Konings (2001) finds that foreign firms are more productive only in Poland. Evidences of the positive vertical spillovers are clearer in literarure. Lui (2008) finds positive vertical spillovers with backward and forward linkages between industries in China. Javorick (2004) casts doubt on positive horizontal spillovers from foreign firms in Lithuania but underlines the existence of vertical spillovers from the upstream sector. Javorick and Spatareanu (2008) also show the importance of local participation for vertical and horizontal spillovers in Romania.

Multinational firms may have more incentives to transfer knowledge to local firms in the upstream sector. Indeed, multinational companies could benefit from this knowledge sharing with better performance of their suppliers of intermediate inputs. Better productivity of local suppliers could thus be a consequence of deliberate knowledge transfer from multinational or higher requirement to local firms in term of product quality and time delivery. Recent firm-level studies conclude in favour of higher productivity of the industries supplying foreign companies (Blalock and Gertler, 2004 in Indonesia; Javorick, 2004 in Lithuania, and Javorick and Spatareanu, 2008 in Romania).

3. Measures of Firm-Level Productivity: Methodological Aspects

The first challenge is to measure firms' productive performance in a relevant way. We propose different approaches and measures. We first consider a non-parametric model of productivity, which consists in calculating productive performances without estimating a production function. The non-parametric measure of productivity constitutes a simple and already meaningful way of assessing for example Labor Productivity (*LP*) and Total Factor Productivity (*TFP*). Another way has been to calculate firms' productive performance from a parametric production frontier. This more sophisticated methodology allows the identification of the most

efficient firms of the sample and the comparison of these most efficient firms with the other firms in the sample.

3.1. Non-parametric measures of productivity

Productivity can easily be calculated as the ratio of an output to a specific factor of production, with labor (*L*) being the main input whatever the industrial sector. When all the relevant factors of the production technology are considered, it is referred to Total Factor Productivity (*TFP*). Our analysis focuses on the second approach, which gives a more complete picture of firms' productive performances. Labor Productivity (*LP*) gives a first idea of a firm productive performance. It has the advantage of not being affected by measurement errors of the capital stock. However, the technology is only partially described and the productivity then suffers from an omitted variable bias. The productivity of Labor can be complemented by the calculation of a Unit Labor Cost defined as the ratio of firm average wage to firm labor productivity. This indicator allows comparisons of the organizational competitiveness across countries. Labor Productivity (*LP*) can be biased by the choice of the exchange rate when converting production into US dollars. This is less the case of the *TFP,* because the same rate applies to the output (*Y*) at the numerator as well as the intermediate inputs (*ICons*), Labor (*L*) and the capital stock (*K*) at the denominator. Under the hypothesis of constant returns to scale, (i.e., perfect competition for goods but also for factors that are remunerated at their marginal productivity), weights of Intermediate inputs (*ICons*) and of Labor (Wages, *W*) are calculated as the ratio of the cost of these factors to the Total Cost of Production including profit (*Y*). The contribution of Capital (*K*) is then calculated as the complement to one.

The advantage of this approach, based on the Solow residual, is that it does not require the inputs to be exogenous or the inputs' elasticities to be constant. However, one inconvenience is that two hypotheses, which prove to be sometimes restrictive, have to hold: constant returns to scale and competitive input markets. Another limitation is that because productivity is calculated as the residual of the

production function, it is considered as a random variable, which makes it difficult to justify that some exogenous factors can explain productive differences. In this chapter, due to the limited time dimension for the production factors (three years) and no time dimension for the Investment Climate (*IC*) variables, we focus only on productivity levels[73].

$$TFP_i = \frac{Y_i}{L_i^{\omega_{1i}} ICons_i^{\omega_{2i}} K_i^{(1-\omega_{1i}-\omega_{2i})}} \quad (1)$$

$$\omega_{1i} = \frac{W_i}{Y_i}, \quad \omega_{2i} = \frac{ICons_i}{Y_i} \quad (2)$$

3.2. Parametric production functions and production frontiers

In the parametric approach, *TFP* is calculated as the residual of an estimated production function, thus relaxing the hypotheses of constant returns to scale (but not automatically of productivity as a random variable). Various hypotheses can be made regarding the technology of production. The Cobb Douglas and the Translogarithmic production functions are the most commonly used. Although both present good mathematical properties, the elasticities of the production to the inputs are easier to read and to interpret with the Cobb Douglass technology. In the case of a parametric production function, production is derived from the optimization problem of the firms, which maximize current and expected profits by equating production prices to their marginal costs. This hypothesis does not allow any waste of resources or organizational weaknesses. The production frontier approach, however, allows for non-optimal behaviors of the firms. Enterprises can

[73] Measuring productivity in level, although more restrictive than measuring growth rates (it requires for example specific functional forms of the production function) is less demanding in terms of data quality conditions. It allows, in particular, unbalanced panels with short term dimension, measurement errors, or constant value of *IC* variables (see Escribano and Guasch, 2005).

be positioned relatively to the most efficient firms that define an empirical production frontier. Firm-level Technical Efficiency (*TE*) can then be defined as the firms' productivity gap to the "*best practice",* the empirical practice of firms which are located on the production frontier.

The deterministic parametric production function approach can be implemented in a rather simple way, under the restrictive assumption that production does not suffer from the classical disturbances. The higher positive residual of the regression is used as a correction term, to position all the observations of the sample comparatively to the most performing ones. The residual of the estimation (u_i) is a random variable, uncorrelated and independent of the right-hand side variables. u_i can be transformed as an indicator of efficiency of value 1 (or 100% when expressed in percent) for the best performers. For the other firms of the sample, u_i then measures the potential performance gain that these enterprises can achieve.

In the stochastic model, the likelihood estimation method is typically applied to estimate a "composite" error term, which includes two uncorrelated elements. The first term *(v)*, which is a random variable, represents the external shocks to the firm. These shocks are independently and identically distributed and follow a normal distribution, with zero mean and σ^2 standard deviation. The second term represents the Technical Efficiency *(-u)*. In this specification, firms' productive performances are not assimilated to a random variable and can then be explained by exogenous factors. The interest of this approach can also be seen in the fact that *TEs* having a relative form, firm productivity can be compared to (or benchmarked by) the most efficient ones across countries and regions.

A complementary approach, after having calculated the Technical Efficiency (*TE*), is to explain firms' diverse performances. Firms' inefficiencies can be explained by "exogenous" factors, which affect either the technology of production, or the firms' ability to transform inputs into outputs. In the literature, these factors have been estimated in two different ways. A simple method consists of estimating the stochastic production frontier, and regress the technical efficiency on a vector of

explanatory factors. This method is called the two-steps procedure. Different estimation procedures can be used in the second step. The simplest way is to run an OLS regression. Another possibility is to apply a Tobit model, in order to address the question of the distribution of the efficiency.

The two-steps procedure presents, however, several shortcomings. It has been criticised for the restrictive underlying assumption, that econometric determinants of productivity or technical efficiencies (*"z"* factors), that are assumed to be identically distributed, are not correlated with inputs (*"x"*). Unfortunately, there are good reasons to believe in such a correlation (Kumbhakar and Lovell, 2000). In this case, omission of the z-factors in the first-step of the stochastic frontier model enhances biased estimations. For a long time, the importance of this potential bias has been a debated issue with little empirical evidence. In Caudill and Ford (1993), this bias does exist, but only for the estimated technological parameters, not for the efficiency levels themselves or their relationship to the *"z"*. Schmidt and Wang (2002) have contributed to give deeper insight. By performing Monte Carlo simulations, these authors analyse the properties of the two-step method. They find that the estimates of inefficiencies in the first stage are seriously biased so long as *"x"* and *"z"* are correlated. Moreover, they establish that even when *"x"* and *"z"* are not correlated, the effect of the *"z"* factors in the explanation of inefficiencies is incorrectly estimated. The most efficient solution then consists of estimating a "one step" frontier model, as suggested by Huang and Liu (1994) and Battese and Coelli (1995).

3.3. Stochastic Frontier Analysis incorporating technical inefficiency determinants

3.3.1 The "one step" estimation procedure

Our first objective is to explain firms' technical inefficiencies through different groups of variables reflecting organizational as well as economic and institutional factors. The second objective is to evaluate how foreign firms could be affected by these factors and the potential positive externalities for the domestic firms in doing business with the foreign companies. The empirical analysis follows the "one step"

estimation method by which the coefficients of the production frontier and the determinants of the firm inefficiency are simultaneously estimated. Stochastic Frontier Analysis (SFA) has the advantage to be statistical model with the possibility of testing hypotheses underlying the parameters of the production technology. In addition, in comparison with a deterministic approach, it accounts for the presence of random disturbances. These valuable advantages come at the cost that SFA presumes the specification of a specific distribution for the inefficiency term -the truncated normal distribution being retained- and a functional form that can be restrictive when describing the technology[74].

This model is based on the conditional mean approach. Inefficiency distribution is assumed to be truncated with a mean depending on the inefficiency covariates[75]. The estimation of the frontier and its determinants require the maximum likelihood technique, which assumes that technology factors *"x"* and the inefficiency covariates (z) are not correlated to avoid a potential endogeneity problem. The stochastic frontier model takes the following form:

$$Y_{csit} = f(X_{csit}, D_c, D_s, D_t, \beta) e^{V_{csit} - U_{csit}(Z_{csi}, \delta)} \qquad (3)$$

Y_{csit} is the output of the firm i in country c and sector s during year t. X_{csit} is a vector of inputs. D_c, D_s, and D_t reflect respectively country, sector, and years dummies introduced in order to capture the heterogeneity of the production technology across countries and sector[76]. Labor (L) and technical capital (K) have been retained

[74] The results are not very sensitive by considering alternative statistical distributions such as exponential, half-normal, etc (Coelli, Prasada Rao and Battese, 1998).

[75] The mean of this distribution depends on some covariates that will be discussed later. According to Greene (2005), potential correlation effects with the input vector could be reduced through the inclusion of these effects in the mean specification.

[76] The panel data associates both firms and countries. Country, sector, and year dummies are introduced to capture the heterogeneity that is not explained by technical inefficiency factors. These dummies pick up the effect of country or sector specific factors, such as endowment in natural resources, national-level institutions, macro or political instability, trade policy, etc.

as inputs and *f(.)* is a suitable functional form. The stochastic frontier specification decomposes the total error term that we denote ε_{csit} into two components: the usual random noise V_{csit} and the asymmetric error term $U_{csit}(Z_{csit}, \square)$, which depends on the z-factors affecting the inefficiency distribution denoted *U* (see, Battese and Coelli 1995):

$$U_{csit} = Z'_{csi}\delta + \eta_{csit} \qquad (4)$$

Z' is the vector of the *p-1* variables Z_j, which may affect the inefficiency distribution, while η is a truncated random normal variable $N(0, \sigma_U^2)$ and δ a vector of the parameters to be estimated. Several assumptions underlie the maximum likelihood estimation of the production frontier. First, *X* and *Z* are not correlated with the random error terms: *V* or η, which are themselves not correlated. The independence assumption between the *Z* variables and η can be violated in some cases. Inefficient firms can choose an unfavourable environment represented by some variables of the *"Z"* factors such as: bad geographic location, inappropriate skilled workers, etc. In addition, inputs (*"X"*) can be correlated to the vector of technical inefficiency determinants (*U*) if firms know that they could reduce their input consumption. In the framework of time-series productivity analyses, one attempt to solve this problem has been the Olley and Pakes (1996) semi-parametric solution[77]. The time dimension in this paper is quite short, not allowing the implementation of this procedure.

With the production frontier being estimated, firm technical inefficiency can be derived. Jondrow *et al.* (1980) conditional method is the commonly used estimator. As inefficiency terms *(U)* are not identically distributed, comparisons across firms prove difficult when the *Z* vector components are not the same. We are reminded that in this particular case, it is assumed that if two firms: *i* and *j*, have the same

[77] The Olley and Pakes (1996) procedure uses firm's investment decisions to proxy unobserved time-varying productivity shocks. Instead of investment decision, Levinshon and Petrin (2003) propose to use intermediate inputs to control for productivity shocks.

inefficiency level with a different *Z* vector, the two truncated distributions are different.

3.3.2 Adjusted efficiency measurements for environments

Coelli *et al* (1999) have proposed *adjusted measures* of the inefficiency component by predicting scores with the most favourable environment, all with firms sharing the same truncated distribution. When dealing with large samples, this procedure may suffer from sensitivity to outliers in the observed z_j. Then, depending on the variable, we project firms by adopting the best environment in the sample. The best environment is represented by the 95% quantile when the environmental factor is favorable (i.e., workforce education), and by the 5% quantile in the opposite case (i.e., electricity constraint). The following formula then applies -subscripts are limited to firm level for simplification purposes:

$$TE_i^a = \frac{Y_i}{f(X_i, \beta)e^{-U_i(Z_i^a, \delta)}} = e^{-U_i(Z_i^a, \delta)} \qquad (5)$$

where z_i^a is the adjusted vector of the inefficiency determinants. Let us mention that the adjustment of the z_j variables depends on the sign of the estimated coefficient δ_j. If δ_j <0, the z_j variable has a positive impact on the efficiency score; then, we adjust firm's performance by the upper quantile of that variable. In the opposite case, the adjustment is done by the lower quantile:

$$\begin{aligned} z_{ji}^a &= \max(z_{ji}, q_{z_j}^{(1-\alpha)}) \text{ if } \delta_j \leq 0 \\ z_{ji}^a &= \min(z_{ji}, q_{z_j}^{(\alpha)}) \text{ if } \delta_j > 0 \end{aligned} \qquad (6)$$

where $q_{z_j}^{(\alpha)}$ is the α-quantile of the variable z_j. Our adjusted measure of the productive performance allows an appraisal of the impact of each of the four dimensions of the z_j variables: infrastructure, human capital, finance, and institution. Coelli et al. (1999) report the following adjusted inefficiency measure:

$$TE_i = E(\exp(-U_i^c) \mid \varepsilon_i) = \left\{\exp\left[-\mu_i^a + 0.5\sigma_*^2\right]\right\} \times \left\{\Phi\left[\frac{\mu_i^a}{\sigma_*} - \sigma_*\right] / \Phi\left[\frac{\mu_i^a}{\sigma_*}\right]\right\} \qquad (7)$$

Where $\Phi(.)$ denotes the distribution function of the standard Gaussian random variable. $\mu_i^a = (1-\gamma)Z'^a_i\,\delta - \gamma\varepsilon_i$; $\sigma_*^2 = \gamma(1-\gamma)(\sigma_u^2 + \sigma_v^2)$, $\gamma = \sigma_u^2/(\sigma_u^2 + \sigma_v^2)$. Z'^a_i is the adjusted vector of systematic influences on technical inefficiencies *(6)*. If we replace the adjusted vector Z'^a_i by the firm observed vector Z'_i in equation *(7)*, an unadjusted inefficiency measure is obtained.

Finally, five different adjusted technical efficiency measures are proposed by distinguishing among five different groups, reflecting infrastructure, human capital, finance, property right, and regulation variables. The decomposition allows for the identification of the intensity of the effect of each group in promoting firms' efficiency.

4. The ICA Surveys and data limitations

The World Bank Investment Climate (*ICA*) surveys collect data on input and output, as well as on various aspects of firms' characteristics (ownership, export share, etc.) and the investment climate at the firm level. The standard questionnaire collects data on firm production, investment and employment decisions. It also covers information such as public regulation, governance, and access to finance or infrastructural services. In all of the five countries, the national sampling procedure is supposed to be a random sample, reflecting the distribution of the firm population. Although ICA datasets are rich on a wide range of topics, practical problems giving rise to potential pitfalls are not negligible. For example, firms do not necessarily report the full range of the investment climate variables. The problem then arises in knowing whether missing variables are due to a random event or not. In addition, the time dimension of the surveys is quite limited. On the one hand, firms generally provide information in relation to their production technology during three consecutive years, but, on the other hand, they do not give a dynamic insight on their external environment over the same empirical period. Last, but not least, the standard questionnaire covers objective or "hard figures" as

well as perception data from respondents. Therefore, if it is not a white noise orthogonal to other variables, subjectivity can mislead the statistical inference.

4.1. Inefficiency determinants and potential endogeneity bias.

Many variables in the ICA datasets refer to firm "perceptions" [78]. Comparisons then prove difficult, especially on an international basis. Perceptions make respondents prisoners from the environment they know, or they may expect on a normative basis. The perception of the scale might be different across firms, industries, regions, and countries. Besides, when answering the questions on their investment climate, firms may be influenced by the perception they have of their own productivity and may attribute their inefficiencies to external factors. High-performing firms, as well, may be proactive in reducing their investment climate constraints, for example by working with the authorities to limit inspections or secure more reliable power supply. This means that a given condition, for example, a feature of the public governance, can be considered differently across countries and regions. The 2004 edition of the World Bank *Doing Business* has illustrated this point, where Belarus and Uzbekistan ranked ahead of France, Germany, and Sweden in the firms' satisfaction with the efficiency of government. Would these perceptions have been the same if entrepreneurs have had the opportunity to project their business in an international environment other than their own? Survey questions on perceptions do not always elicit meaningful responses because of the scaling of responses, unwillingness of respondents to admit their lack of knowledge, or their lack of a reference point for answering. Another problem arises with the causal inference and the accompanying potential endogeneity bias that may result. The risk is that firms blame their external environment, while the main problem results from their own organizational behaviour. For this reason, in this analysis, we retain only objective variables that are not subject to firms' subjective judgments. Although the use of objective variable reduces endogeneity problem arising from measurements errors, simultaneity bias could remain.

[78] Firms are asked to quantify their constraints on a scale going from none to very severe.

These limitations can be addressed by different means. One solution is the instrumentation. The efficiency of this method is dependent on the possibility to find exogenous instruments to proxy the suspected variables. Replacing the individual responses by regional-sector averages of the indicators is a way to manage the problem. Although this approach is not relevant for variables that depend on firms' characteristics, it is considered acceptable for describing their external environment (Dollar et al, 2005; Commander and Svejnar, 2008). A main limitation of this method occurs if firms self-select their environment according to their ex-ante calculus. We may expect that efficient enterprises choose to evolve in areas such as export promoting zone where they benefit from the best external conditions. To address the self-selection bias, one can control for variables such as size or ownership, or a robustness analysis can be done on a sample of small local firms that are not able to choose their location. The area being given, small enterprises are more relevant to reflect the relation between the external environment and technical inefficiency under the hypothesis that this area combines good as well as poor productive performers (cf Dollar *et al,* 2005). Incidentally, regional averages about characteristics of the external environment can also be used to complete firms' missing information[79].

4.2. Non-respondent firms and potential sub-sample selection bias

Investment Climate Surveys rely on large random samples of firms that are supposed to reflect the true sector-based population of each country. However, the estimation of the production technology, on one hand, and the incorporation of the technical inefficiency determinants on the other hand, can be a source of distortion at the level of the initial surveyed population. This distortion depends on the econometric specification of the model and the number of non-respondents, which varies a lot across country surveys, as well as the type of the investment climate indicators. Unanswered questions can be considered too complex or politically

[79] Imputation by the mean concerns only the firms who provide complete information on their production technology and have some missing observations for the z factors.

sensible. Then, the potential presence of self-selection bias can be suspected. *A priori*, one cannot ignore the fact that characteristics and behaviors differ across firms depending on whether they are present or not in the final empirical sub-sample. Our final sample of five developing countries retained for this analysis does not suffer from this potential bias. Almost all firms are retained in the empirical analysis for these five surveys.

4.3. ICA surveys and the time dimension

For production technology, ICA datasets contain the data for the surveyed-year and two years before. However, investment climate indicators refer only to the current year. Although some countries have been surveyed twice, the "one step" frontier model cannot be estimated under the conventional time-series-cross-section panel data form as the population of firms differs. In a cross sectional analysis, strong assumptions underlie the breakdown of the composed error model. The stability of the productivity in line with Aigner *et al* (1977) specification of the stochastic frontier model (i.e., without the factors explaining inefficiency), has been tested for three subsequent years. Productivity measures being estimated rather than observed, non-parametric kernel estimates of productivity density have been used. Kernel distribution graphs show that the three distributions overlap (Appendix 1). Therefore, the idea that the frontier with the z-factors is not specific to an empirical year seems reasonable. Moreover, although we do not refer to the standard panel frame, combining firms, sectors, and countries has some advantages. First, statistical inference can be done on average country-sector distributions of the technical inefficiencies, and then in reducing the variance of the residual term, we would observe in a *pure* cross-sectional analysis. Second, in this empirical frame, we can control for the time invariant heterogeneity common to all firms in a specific sector with country and sector dummies. One can reasonably suppose that while firm production could vary slightly within three years, investment climate is a more structural factor that could be constant during three consecutive years (Dollar et al., 2005). There are thus three alternative ways to estimate and explain firm productivity. The first one is to consider only production function variables and

investment climate variables during the survey year. The second option is to estimate the production function for the available three years and explain the averages of the productivity during these three years by the investment climate variables. This method is not applicable in our case since it refers to a two-steps procedure. The last option is to consider the investment climate variables as fixed during the three years and allow for some variability in the production function. Similarly to Dollar et al. (2005), we retain the last option in this chapter.

4.4. Exchange rate issue

The exchange rate constitutes another source of uncertainty, which may lead to over or under evaluate firms' productive performances. This rate is used to convert production and production factors into US dollars. Several exchange rates can be chosen to calculate and compare firm-level productivity across countries. In this study, we considered the current market rate in US dollars, which offers the advantage of being the rate that firms use for their economic calculations[80].

[80] The choice of an adequate exchange rate depends, among other things, on the exchange rate regime of the country. In presence of a floating exchange rate regime, the volatility of the current exchange rate may affect the perception of the productive performances. This is particularly true for the Labor Productivity (*LP*). For Total Factor Productivity (*TFP*), this problem is somewhat attenuated by the fact that the same exchange rate is used to convert intermediate consumptions and capital in the denominator, and production in the numerator. Using current exchange rate introduces, as well, a bias for example when fixed exchange rate policy leads to an overvaluation of the currency, or when the floating rate suffers from overshooting. Current exchange rate has the advantage to represent the rate that firms deal with when making their own economic calculations. The producer faces this rate when he competes on external as well as domestic markets. Both, a constant exchange rate or the use of a Purchasing Power Parity (*PPP*) exchange rate with the US dollar, are surely more problematic for our analysis. *PPP* conversion rate is useful when comparing purchase power of income per capita. We know that the purchasing power in developing countries tends to be higher when GDP per capita is converted using nominal exchange rate. But when dealing with production, current rate is more representative of the enterprises' economic reality. The choice of exchange rate does not seem, to change radically the perception of the firms' productive performances. The coefficient of correlation of our two measures of firm-level productivity using alternatively current and constant exchange rates is relatively high.

4.5. Selected sample and variables

Based on the *ICA* surveys, we define the investment climate by four categories: quality of infrastructure, institutions, human capital, and finance. Indicators have been selected based on availability and objectivity as well as their capacity to capture the different key dimensions of the investment climate. The quality of infrastructure is captured by electricity problems leading to the use of generators by firms to produce their own electricity. This variable captures the electricity problem but also the firm response to this constraint. More capitalistic and productive firms could indeed rely more on their own generator to produce electricity in a context of insufficient and unreliable electricity provision. Human capital is captured by the percentage of workforce with secondary education. Financing problems are represented by the firms' lack of access to formal finance such as overdraft facility in their activity. The share of informal sources of finance in firms' working capital is used to capture this aspect. The business-government relations or institutional factors are represented by the time devoted to regulation management, more precisely the percentage of senior managers' time spent dealing with government regulation such as licensing and registration. Institutional factors are also captured by the regulation of labor and property rights protection.

Based on the narrowly defined industries across countries of the enterprises surveys, we redefined five aggregated sector using two-digit ISIC Rev.2 classification[81]. The five sectors defined are Textile, Wearing Apparel and Leather; Food, Beverage and Tobacco; Wood and Wood Products including Furniture; Chemicals and Plastics Products; and Manufacture of fabricated metal products, Machinery, and Equipment. This analysis includes 4510 firms from five developing countries over the period 2000-2005: Brazil (2003), Morocco (2004), Pakistan (2002), South Africa

[81] Two-digit ISIC Rev.2 classification is the closest aggregated sector-level classification to the one already defined in data.

(2003), Vietnam (2005)[82]. Countries were chosen according to the availability of the nation-based statistical information, which is pooled to constitute an international panel on the manufacturing sector.

5. Empirical results

The Total factor productivity *(TFP)* is calculated from a non-parametric relation as indicated in section 3.1[83]. Table 1 presents the firm-level *TFP* by sector under the assumption that a sector-based technology leads to more homogenous production function.

[82] The number of firms by country is as follow: Brazil: 1474, Morocco: 789, Pakistan: 822, South Africa: 432, Vietnam: 993.

[83] The value added is the difference between total sales and total purchase of raw material. The number of permanent workers and total wages capture labor and capital is represented by the gross value of property, plant, and equipment.

Table 5.1: Mean and median of firm-level total factor productivity

	Period t		Period t-1		Period t-2	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**
Food and Beverage						
Brazil	0,90	0,93	0,85	0,96	0,83	0,91
Morocco	0,64	0,68	0,30	0,42	0,43	0,57
Pakistan	0,59	0,44	0,46	0,42	0,44	0,38
South Africa	1,10	1,23	1,06	1,11	0,83	1,03
Vietnam	0,22	0,26	0,15	0,22	0,29	0,34
Textile and W. Apparel						
Brazil	1,02	0,98	1,08	1,07	1,09	1,08
Morocco	0,77	0,72	0,75	0,72	0,71	0,68
Pakistan	0,81	0,65	0,63	0,52	0,50	0,36
South Africa	1,18	1,06	1,17	1,00	1,12	1,08
Vietnam	0,23	0,29	0,22	0,25	0,10	0,19
Wood incl. furniture						
Brazil	0,92	0,89	0,98	0,96	1,00	1,01
Morocco	0,22	0,26	1,20	0,67	-0,02	-0,33
South Africa	1,13	1,02	1,06	1,06	1,06	0,91
Vietnam	0,47	0,44	0,39	0,38	0,38	0,32
Chemicals and plastic products						
Brazil	1,10	1,11	0,92	0,92	0,92	0,78
Morocco	0,80	0,60	0,74	0,63	0,71	0,52
Pakistan	0,67	0,55	0,52	0,50	0,34	0,34
South Africa	1,10	1,04	1,26	1,19	1,24	1,16
Vietnam	0,25	0,28	0,20	0,27	0,22	0,23
Machinery and Equipment						
Brazil	0,94	0,91	0,97	0,91	0,93	0,86
Morocco	0,90	0,64	0,81	0,70	0,97	0,86
Pakistan	0,76	0,77	0,64	0,61	0,60	0,52
South Africa	1,03	0,95	1,02	0,88	0,97	0,88
Vietnam	0,31	0,39	0,43	0,44	0,35	0,44

In all industries and periods, South Africa presents the most performing firms followed closely by Brazil. Vietnam ranks at the bottom of the sample except in the wood and furniture sector, while Morocco and Pakistan have an intermediate position. With the exception of Morocco in the Wood and furniture sector, total factor productivity is relatively constant across the three observed years with some slight increases according to the sector and the country.

5.1 SFA models with technical inefficiency determinants

The Cobb Douglas functional form is supposed to describe the production technology. An alternative functional form such as the translog did not reveal significant differences for the international ranking across the five countries or the national statistical distributions of efficiency measures. The Cobb Douglas technology has the valuable advantage to allow an easy interpretation of the estimated coefficients[84]. SFA, with country, sector, and year fixed-effects and the determinants of inefficiency are provided in Table 2.

[84] The use of a more flexible functional form such as the translogarithmic did not reveal any significant variation of the coefficients of the technology as well as the coefficients of the investment climate variables. With the translogarithmic form, the elasticity of labor and capital is respectively 0.75 and 0.18. The elasticity of labor squared, capital squared, and the cross term between labor and capital is respectively 0.06, 0.05, and -0.05. The Spearman correlation rank between the efficiency with the Cobb-Douglas model and the efficiency with the translogarithmic model is 0.98 and statistically significant at 1%.

Table 5.2: Investment climate and firm-level inefficiency

	Dependent Variable: ln(Value added)			
	(1)	(2)	(3)	(4)
Production Function				
Ln(Capital)	0.178	0.179	0.178	0.178
	(30.30)***	(30.41)***	(30.30)***	(30.25)***
Ln(Labor)	0.736	0.736	0.736	0.736
	(69.30)***	(69.37)***	(69.27)***	(69.05)***
Constant	2.162	2.126	2.166	2.210
	(13.37)***	(13.87)***	(13.16)***	(12.28)***
Investment Climate *(Investment Climate variables are regressed on firm-level inefficiency)*				
Size	-0.134	-0.136	-0.133	-0.134
	(7.66)***	(7.75)***	(7.38)***	(7.48)***
Age	-0.001	-0.001	-0.001	-0.001
	(0.93)	(1.05)	(0.94)	(0.98)
Informal Finance	0.002		0.002	0.002
	(3.13)***		(3.13)***	(3.17)***
Informal Finance^{+}		0.003		
		(1.91)*		
Electricity Problem	0.222	0.207	0.222	0.222
	(4.10)***	(3.75)***	(4.12)***	(4.20)***
Workforce Education	-0.010	-0.010	-0.010	-0.010
	(8.09)***	(8.12)***	(8.01)***	(7.99)***
Property Rights Protection	-0.035	-0.035	-0.034	-0.034
	(2.15)**	(2.13)**	(2.13)**	(2.17)**
Labor Regulation			0.000	
			(0.31)	
Regulation Management				0.006
				(2.63)***
Constant	1.126	1.136	1.113	1.117
	(6.51)***	(6.66)***	(6.24)***	(6.31)***
Observations	8051	8083	8051	8051
sigma_u	*0.26*	*0.27*	*0.26*	*0.26*
	[0.15]	*[0.15]*	*[0.15]*	*[0.15]*
sigma_v	*0.66*	*0.66*	*0.66*	*0.66*
	[0.15]	*[0.14]*	*[0.15]*	*[0.15]*
Wald chi2	17640.05	17078.41	17168.21	17106.39
Prob > chi2	0.00	0.00	0.00	0.00

Absolute value of z statistics in parentheses. Number in brackets for sigma_u and sigma_v are standard errors.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include year, country, and sector dummies.
All investment climate variables are industry-region averages by size and capital ownership except informal finance variable which is firm-level information. Informal finance^{+} is industry-region averages by capital ownership and size.

Although country and sector dummies are significant in average, year dummies are not significant at all, supporting the equality of the distribution of the productivity across the three consecutive years for each country. The sum of inputs' elasticities being not significantly different from one, we cannot reject the assumption of constant returns to scale. The labor coefficient is about 0.74 which is around the usual contribution found in the literature for the relative contribution of wages into the value added. The standard error of the inefficiency component σ_u is significant and thus does not reject the relevance of the stochastic frontier hypothesis against the OLS model where the error term would be the classical random disturbances. This result justifies the production frontier model, against the production function approach. However, the spearman correlation rank highlights that the distribution of efficiency using the stochastic frontier model is close to the non-parametric total factor productivity[85].

In regards to the explanation of the inefficiency determinants, the potential endogeneity bias has been treated at best by using city-sector averages by size and foreign ownership of the investment climate variables[86]. In the case of financing constraints, we use regional averages as well as firm-level information. The results are robust to both definitions of which we retain the firm-level information for the rest of the analysis. Bigger firms are associated with a higher productivity level[87].

[85] The spearman correlation rank between the non-parametric total factor productivity and the parametric technical efficiency score is high (0.62) and significant at 1% level.

[86] We ensure to get sufficient number of firms by city, sector, size and foreign ownership status and the results are robust to alternative way of aggregation of the investment climate variables.

[87] The new literature on international trade associates firms' size with increasing returns to scale. The literature on corporate governance describes the difficulties in inciting and controlling big enterprises, although they are more able to reduce transaction costs and facilitate economic calculations. Small enterprises are described as less capitalistic and more flexible in a volatile environment, in particular in economies characterized by rigidities that encourage the development of the informal economy.

Except labor regulation, all investment climate variables[88] are significant. The financing constraint is strongly negatively correlated with firms' efficiency. Overdrafts facilities potentially mean fewer risks of disruptions in the provision of raw materials and intermediary consumptions and a better ability to finance the working capital. The empirical model also displays the significant impact of public utilities through the presence of electricity constraints. The role of this factor was similarly evidenced in several studies including in Dollar et al. (2006). The quality of human capital, captured by the share of firms' workforce with secondary education is positively and significantly correlated with firms' efficiency., Firms that are more efficient have more skilled workers and are able to absorb new production processes and technologies. Various aspects including property rights protection, labor regulation, and the time spent by firms' managers to deal with government regulations capture the institutional environment. Better protection of property rights is associated with higher technical efficiency and time spent for government regulation is negatively correlated with firms' efficiency. These results highlight the importance of regional variation of institutions, consistently with Dollar et al. (2005). By reducing transaction costs and ensuring investment projects, secure property rights and lower regulatory constraints from government, create a business-friendly environment, stimulating firms' performances.

Firms can choose a location with better infrastructure and production conditions, what relates to the endogeneity of implantation. City or region-sector averages *IC* indicators would not be exogenous regressors if, for example, more efficient firms

[88] Investment climate variables are financing constraint, education level of workforce, electricity constraint, property rights protection, labor regulation, and management of regulation. Financing constraint indicates the percentage of firms working capital coming from informal source. Workforce education represents the percentage of workorce with secondary education. Electricity constraint is the percentage of firms that own or share a generator. Property rights protection is an indicator of protection of property rights by the judicial system scaled from 1 to 6 with higher scale indicating better protection. Labor regulation is the percentage of the optimal level of employment compared to the current level. Regulation management is the percentage of senior managers' time dealing with government regulation.

tend to establish in locations where the investment climate is better. To address the issue of endogeneity relating to firms implantation, we restrict the sample to the enterprises that are less likely to choose their location. Following Dollar et al. (2005), we define this category as domestically owned firms employing less than 150 workers (henceforth, small local firms) by excluding from the sample the foreign as well as large domestically owned firms. Results of this new set of estimations confirm the previous findings (see appendix 2). Investment climate constraints still reduce significantly firms' performances. The results show that small and medium domestic firms are particularly affected by changes in the different dimensions of the investment climate.

Next to the importance of the investment climate, foreign firms[89] are associated with higher productivity justifying externalities in terms of new technologies and management techniques linked to foreign participation[90] (table 3). This finding supports the prediction of a large part of the theoretical and empirical literature that highlights the better productive performances of foreign firms. The positive and significant correlation between foreign firms and efficiency could mean that, because of sharing of better management and production practices, foreign acquisition increases the productivity of firms. This could also suggest that multinational companies are acquiring the most productive local firms, leading to simultaneity bias.

[89] Following the IMF standard definition of FDI, the foreign ownership variable is a dummy taking one if at least 10% of the firm's capital is foreign and zero otherwise.

[90] As in Commander and Svejnar (2008), the impact of export orientation is rejected, when export and foreign ownership variables are introduced together in the model. Therefore, non-significance of the export variable does not mean that correlation with inefficiencies does not exist at all. In this working paper, Commander and Svejnar refer to the 2005 and 2002 Business Environment and Enterprise Performance Surveys (BEEPS) collected by the European Bank for Reconstruction and Development (EBRD) and the World Bank. Firms are from a wide range of sectors across 26 transition countries.

Table 5.3: Foreign ownership, investment climate and firm-level inefficiency

	Dependent Variable: ln(Value added)			
	(1)	(2)	(3)	(4)
Production Function				
Ln(Capital)	0.184	0.178	0.175	0.175
	(31.30)***	(30.25)***	(29.55)***	(29.50)***
Ln(Labor)	0.744	0.736	0.733	0.734
	(73.02)***	(69.05)***	(68.91)***	(66.17)***
Constant	1.751	2.210	2.232	2.242
	(13.88)***	(12.28)***	(13.75)***	(8.53)***
Investment Climate *(Investment climate variables are regressed on firm-level inefficiency)*				
Size	-0.158	-0.134	-0.138	-0.134
	(8.64)***	(7.48)***	(8.06)***	(6.84)***
Age	-0.001	-0.001	-0.001	-0.001
	(1.45)	(0.98)	(1.39)	(1.50)
Foreign Firm	-0.287		-0.153	-0.149
	(4.90)***		(3.68)***	(3.55)***
Export (% of sales)				0.000
				(0.92)
Informal Finance		0.002	0.002	0.002
		(3.17)***	(3.12)***	(3.19)***
Electricity Problems		0.222	0.211	0.220
		(4.20)***	(3.88)***	(4.18)***
Workforce Education		-0.010	-0.009	-0.009
		(7.99)***	(8.26)***	(7.02)***
Property Rights Protection		-0.034	-0.029	-0.029
		(2.17)**	(1.86)*	(1.88)*
Regulation Management		0.006	0.007	0.006
		(2.63)***	(2.88)***	(2.94)***
Constant	1.169	1.117	1.142	1.191
	(9.39)***	(6.31)***	(6.42)***	(5.29)***
Observations	8272	8051	8036	8008
sigma_u	*0.23*	*0.26*	*0.26*	*0.26*
	[0.17]	*[0.15]*	*[0.15]*	*[0.16]*
sigma_v	*0.68*	*0.66*	*0.66*	*0.66*
	[0.15]	*[0.15]*	*[0.15]*	*[0.16]*
Wald chi2	19323.41	17106.39	16522.23	15873.94
Prob > chi2	0.00	0.00	0.00	0.00

Absolute value of z-statistics in parentheses. Number in brackets for sigma_u and sigma_v are standard errors.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include year, country, and sector dummies.
All investment climate variables are industry-region averages by size and capital ownership except informal finance variable which is firm-level information.

This section also offers an analysis of the investment climate as a potential transmission channel through which foreign ownership could affect firm productivity. The hypothesis being that foreign firm could benefit from a better business environment than local firms leading to higher productivity. When the investment climate variables are introduced in the regressions, the coefficient of the foreign firm variable is significantly reduced, indicating that better investment climate of the foreign firms is one transmission channel of the positive effect of foreign ownership on firms' productivity.

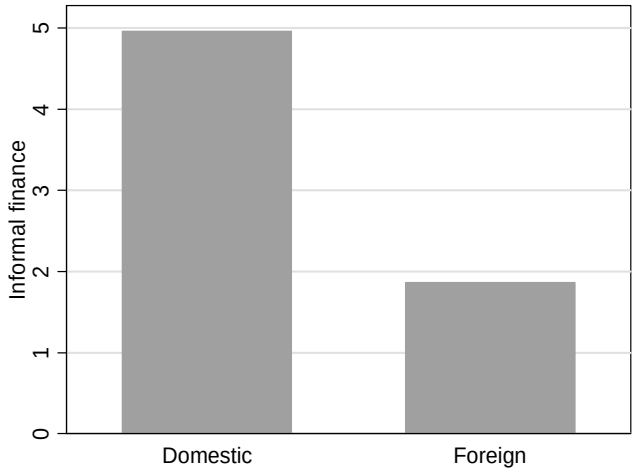
The chapter thus proposes an alternative way to analyze why foreign firms are more productive than local ones. Beyond the usual argument of access to better technologies and management practices, we suggest that foreign firms could be more productive because they benefit from a better investment climate when doing business compared to local firms. The investment climate which is supposed to be identical across all firms operating in the same area could be different for foreign firms or at least affect them differently. Foreign firms could in fact resist more to a degradation of their investment climate or even positively influence it, or they can locate in areas where the investment climate is more favorable (chapter 3).

The following graphs confirm that on average, foreign firms benefit from a better investment climate. Financing constraints and lack of education of the workforce seem to be two major constraints affecting particularly domestic firms compared to the foreign ones. Foreign firms rely more on their own generators to produce electricity. This situation highlights the unreliable provision of electricity, forcing firms to adopt a more costly alternative. Given their higher financing constraints, limiting their ability to produce electricity, domestic firms could suffer more from electricity problems compared to foreign firms. Institutional problems affect both categories of firms in around the same magnitude. The exception is the property rights that are more secure for foreign firms.

Figure 5.1: Major investment climate variables and capital ownership

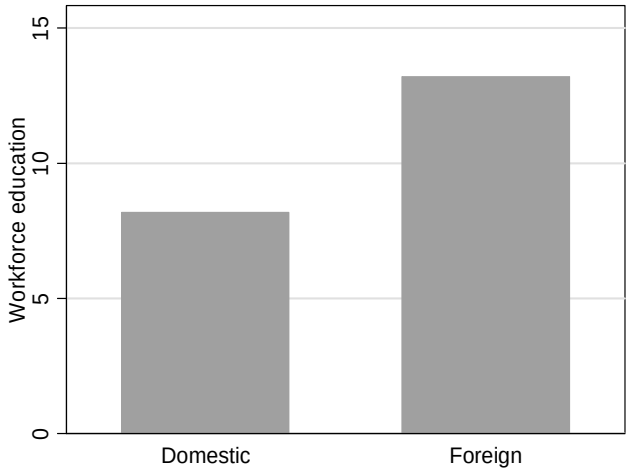
Financing constraint and capital ownership

(Financing counstraint: % of firms working capital from informal source)



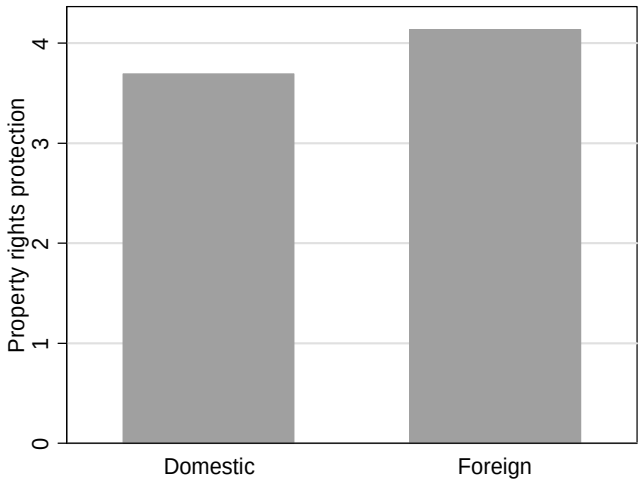
Workforce education and capital ownership

(Workforce education: % of workorce with secondary education)



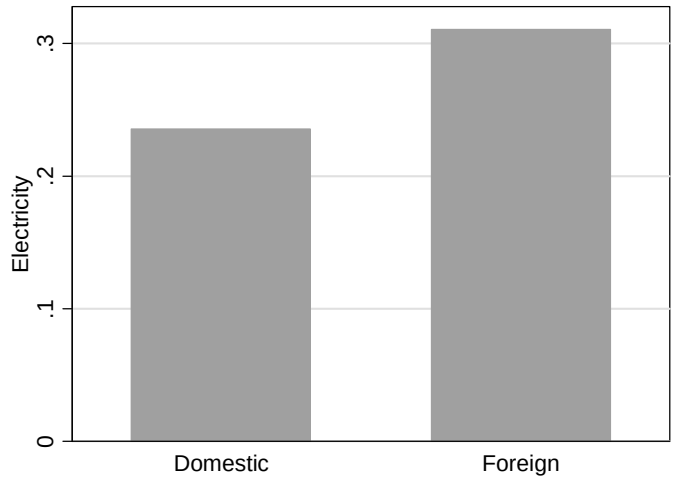
Property rights protection and capital ownership

(Property rights protection: Protection of property rights by the judicial system: scale from 1 to 6)



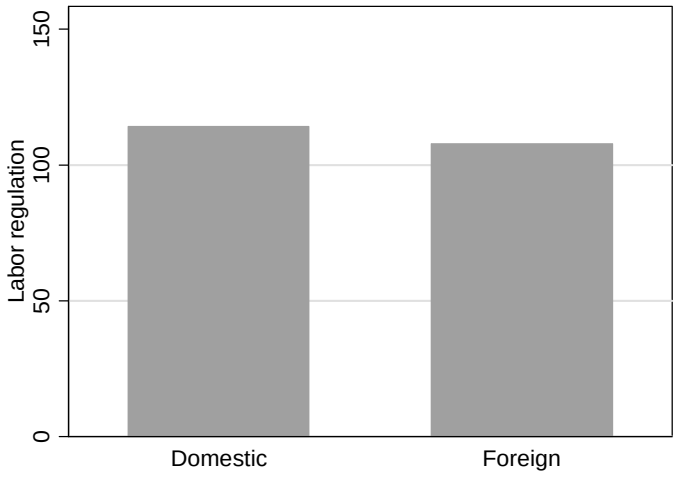
Electricity and capital ownership

(Electricity: % of firms that own or share a generator)



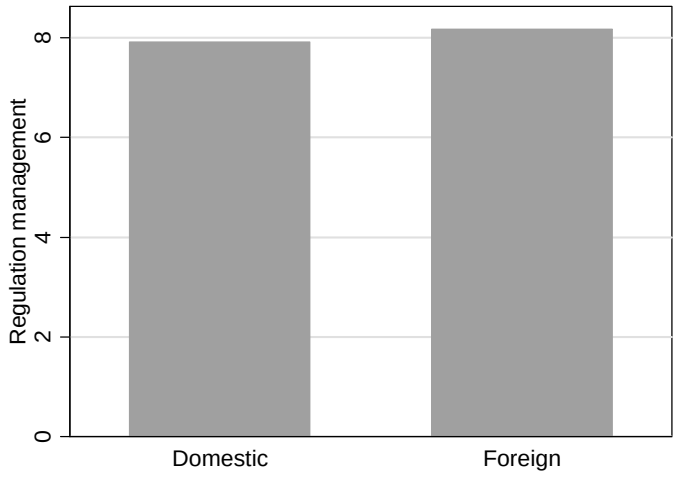
Labor regulation and capital ownership

(Labor regulation: % of optimal level of employment compared to current level)



Regulation management and capital ownership

(Regulation management: % of senior management's time dealing with government regulations)



As explained in section 2.3, foreign firms may face lower investment climate constraints because of their ability to raise external finance, to attract the more skilled workers or to provide consistent training to their employees. Foreign firms can also overcome more easily infrastructure problems such as unreliable provision of electricity by using their foreign expertise and finance to develop costly power generator systems. In term of institutional factors, the argument could go in two opposite directions. Since foreign firms do not know the specific characteristics of the local markets like local firms do, they could face more difficulties when dealing with official regulations and laws. On the other hand, policy makers in many countries -particularly developing countries- often seek to attract FDI with various incentives including tax breaks, lowering of administrative burden, and better guarantee of property rights protection. These incentives could finally lower the administrative cost of doing business and offer better institutional framework to foreign firms compared to the local ones.

A multivariate analysis could provide more credit to these first insights. The following section uses cross terms between investment climate variables and foreign ownership to assess whether foreign ownership effectively helps firms to dampen the negative effect of the investment climate constraints on their productivity.

Table 5.4: Foreign ownership, investment climate and firm-level inefficiency

	Dependent Variable: ln(Value added)		
	(1)	(2)	(3)
Production Function			
Ln(Capital)	0.175	0.174	0.174
	(29.54)***	(29.51)***	(29.48)***
Ln(Labor)	0.732	0.732	0.732
	(68.96)***	(67.59)***	(67.89)***
Constant	2.206	2.337	2.323
	(14.18)***	(10.70)***	(10.86)***
Investment Climate *(Investment climate variables are regressed on firm-level inefficiency)*			
Size	-0.136	-0.128	-0.129
	(7.93)***	(7.18)***	(7.15)***
Age	-0.001	-0.001	-0.001
	(1.33)	(1.55)	(1.47)
Foreign Firm	0.150	0.173	0.050
	(0.54)	(0.92)	(0.20)
Informal Finance	0.002	0.002	0.002
	(3.00)***	(3.17)***	(3.08)***
Electricity Problems	0.252	0.273	0.262
	(4.21)***	(4.76)***	(4.52)***
Workforce Education	-0.010	-0.009	-0.009
	(8.16)***	(8.28)***	(8.14)***
Property Rights Protection	-0.030		-0.028
	(1.72)*		(1.67)*
Regulation Management		0.001	0.001
		(0.23)	(0.29)
*Informal Finance*Foreign Firm*	*0.001*	*-0.001*	*-0.001*
	(0.15)	*(0.42)*	*(0.40)*
*Electricity Problems*Foreign Firm*	*-0.223*	*-0.257*	*-0.248*
	*(1.86)**	*(2.43)***	*(2.30)***
*Workforce Education*Foreign Firm*	*-0.001*	*0.000*	*0.000*
	(0.26)	*(0.03)*	*(0.04)*
*Property Rights Protection*Foreign Firm*	*0.019*		*0.026*
	(0.46)		*(0.66)*
*Regulation Management*Foreign Firm*		*0.013*	*0.013*
		*(3.08)****	*(3.03)****
Constant	1.086	1.008	1.132
	(5.98)***	(5.14)***	(5.57)***
Observations	8036	8036	8036
sigma_u	*0.26*	*0.25*	*0.26*
	[0.15]	*[0.16]*	*[0.16]*
sigma_v	*0.66*	*0.66*	*0.66*
	[0.15]	*[0.16]*	*[0.16]*
Wald chi2	16825.69	15922.96	15978.95
Prob > chi2	0.00	0.00	0.00

Absolute value of z statistics in parentheses. Number in brackets for sigma_u and sigma_v are standard errors. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include year, country, and sector dummies. All investment climate variables are industry-region averages by size and capital ownership except informal finance variable which is firm-level information.

The results show that on average, investment climate constraints jeopardize firm productivity. However, with the exception of regulation management, investment climate problems are not significant constraints for foreign firm efficiency. Foreign firms also positively influence their own investment climate. This is particularly the case for electricity problems were foreign firms handle the use of their own generator in a context of unreliable electricity provision to become more efficient compared to the average firm. Given their relatively limited knowledge of the local markets compared to domestic firms and their more efficient use of time in production processes, foreign companies suffer more from the time spent in dealing with government regulation.

This finding shows that foreign firms are more resistant to a degradation of the investment climate and confirms that foreign enterprises have the possibility to influence positively their investment climate or to establish in locations where the investment climate is more favorable. This outcome should be considered as of first importance, knowing the potential of job creation of local enterprises in developing countries. In accordance with our results, local businesses generally deal with poor investment climate. They have, for example, a more difficult and more expensive access to the financial system. Additionally, they do not have the same power to lobby policy makers to get secure property rights. Local firms also attract less qualified people who would prefer higher salaries in foreign enterprises. They have less the capacity to compensate deficient infrastructure, buying a generator or paying for expensive internet connections (in addition to the fact that they do not choose their location). This makes this category of firms a great potential for an improvement of the industrial sector performance. This is particularly true for developing economies, where small local firms account for a larger share of total firms. Improvement of various dimensions of the investment climate could thus boost competitiveness of the local and small firms on the world market and generate substantial productivity gains in the manufacturing sector. The following section assesses the potential gains of aggregate productivity by projecting firms in the best investment climate in their country, which is the investment climate faced

by the foreign firms. This exercise is firstly made within the sectors of each country and then within each country regardless of the sector.

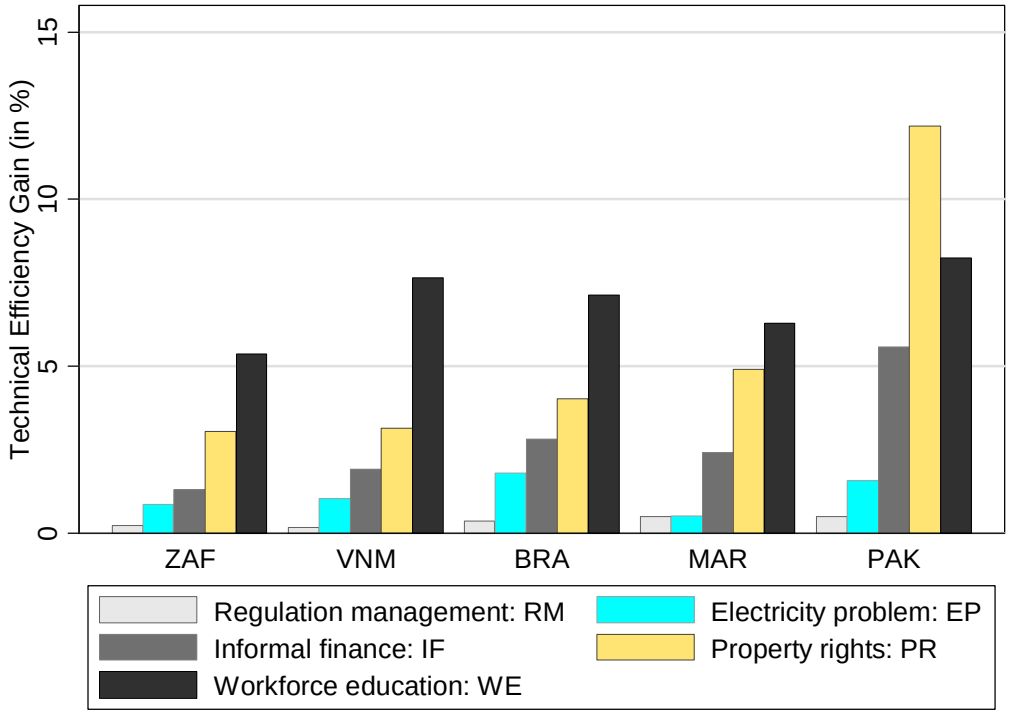
5.2 Adjusted technical efficiency to better investment climate

Firms' efficiencies can be projected in common productive conditions, which are given by the best environments in either the sector, or national frames. Sectoral contexts are likely to be the most realistic ones. By this calculation, we simulate the percentage of technical efficiency that could be gained under the hypothesis that firms operate with the best sector-wide investment climate as captured by our investment climate variables. This reasoning is conducted under the restrictive *ceteris paribus* hypothesis: the performance of firms evolving with the best environment remains unchanged.

For the robustness of these projections, the best 5% firm-environment has been considered for each of the investment climate categories. The same method has been adopted for projecting firms in the best national environments regardless of the sector. On one hand, this second scenario is much more speculative or hypothetical as the availability of skilled workers or the importance of electricity constraints could vary according to the sector of activity. On the other hand, in the context of globalization, with more integrated national and international markets, competition is everywhere and firm competitiveness is affected by all the elements conditioning relative production costs regardless of the sector or industry. Managers, as well as public decision-makers, have to know where the most promising interventions are in order to improve firm integration in a national context and into the world economy. Adjusted measures for the aforementioned environments shed some light on this point[91].

[91] The same exercise has been carried-out with no significant variation with the translogarithmic specification. Results are provided in appendix.

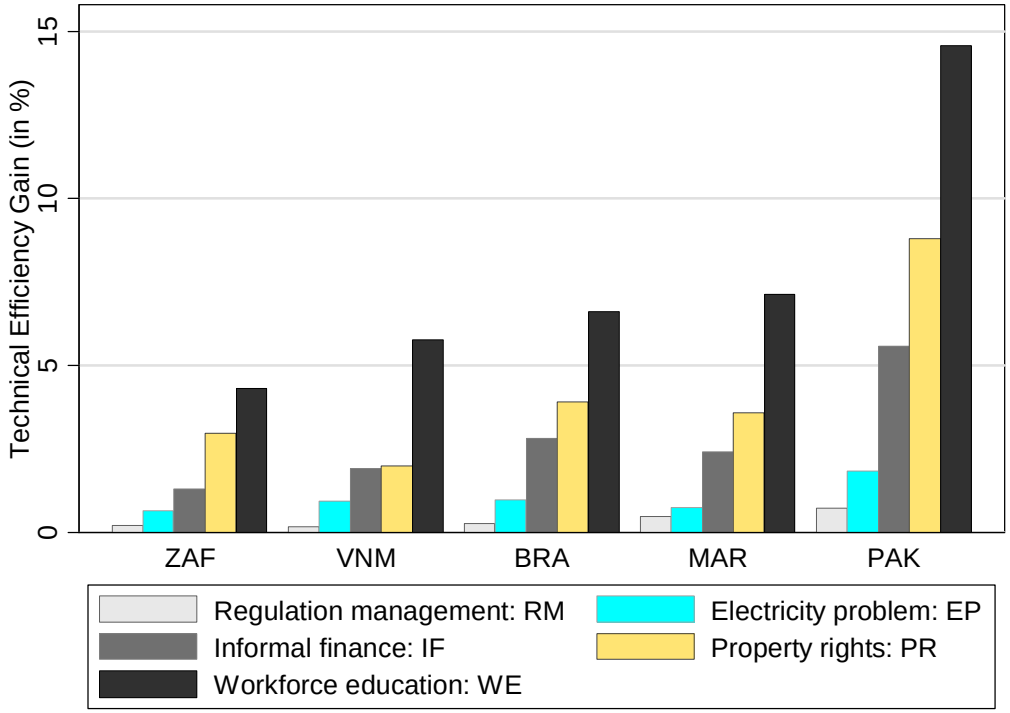
Figure 5.2: Projection to the best environments by sector within the country



From Figure 3, it can be seen that in an industry frame, cumulative efficiency gains range from less than 10% in South Africa to about 20% in Pakistan. On average, these marked differences reflect statistical dispersion, which tends to be more pronounced in the lowest *per capita* GDP countries. Gains with more skilled workers are systematically the most substantial ones, except in Pakistan where the projection to the best property rights provides the highest efficiency gain. For all countries, projection in the best environment of skilled workers and secure property rights of the sector accounts for more than 60% of the total expected gains. When passing from the actual to the best formal rule context in the sector, productive efficiency does improve significantly. Our results are similar to those of Dollar *et al.* (2006) suggesting that local governance is important and institutions vary for each sector across locations within countries. Better access to skilled workers will facilitate the adoption of new technologies and new processes of production, increasing productivity. Access to the best financing condition in each sector, by improving firms' business relation with their client and suppliers of intermediate goods, contributes significantly to higher productive efficiency. Beside the better access to finance, which ranks third in terms of contribution to better productivity, more

reliable electricity provision also boosts aggregate efficiency. A lower burden of regulation management does not significantly improve productive efficiency.

Figure 5.3: Projection to the best environments within the country (all sector)



When efficiency scores are adjusted to the most favorable national (all sectors) conditions (Figure 4), the conclusions are similar and consistent with the views associated with the role that human capital, institutions, and finance play in the development process. Efficiency gains range from less than 10% in South Africa to around 25% percent in Pakistan. Among all categories of the investment climate, human capital ranks first across all countries. The quality of human capital accounts for almost 50% of the simulated improvement in Pakistan. Projections for Morocco and Brazil in the best environment lead to aggregate productivity gain of more than 10% with human capital and institution representing more than half of the gain. In Vietnam, the availability of skilled workers overrides everything else. Finally, projections are of limited interest for South Africa, where the dispersion in the quality of the investment climate is more limited. These last results remind us of the hypothesis underlying projections, with all of them being carried out within the

methodological frame of the *best practice* with accompanied implication: the conditional results upon the empirical sample we refer to.

Beyond their direct effect on aggregate productivity, foreign firms could also improve country-level productivity by improving the performances of local firms. This refers to the literature on spillovers effects from foreign firms to the local enterprises.

5.3 Sales to multinationals and spillovers

The literature distinguishes horizontal from vertical spillovers. Horizontal spillovers refer to the increase of a sector aggregate productivity due to the entry of foreign firms with higher productivity in this sector. This leads to incentives for other firms to increase their productivity in a more competitive environment. Higher productivity with horizontal spillovers could be achieved by copying new technologies and production processes, or by hiring trained workers and managers from foreign firms. Local firms with the lowest productivity performance and that are not able to catch-up with the higher performance of the other firms in the sector could be crowded-out of the market.

Firms doing business with foreign companies could benefit from positive externalities. This refers to vertical spillovers and affects domestic firms that supply goods or services to foreign firms as well as domestic companies that are clients of foreign firms. In fact, foreign firms could require higher standards from their local suppliers, leading to higher productivity. Foreign firms could also provide higher standard products to their domestic clients leading to better productive performances.

Empirical analyses studying spillovers effects from foreign firms use input-output matrix to derive sector-based indicators of spillovers. These proxies are, for horizontal spillovers, the share of a sector output produced by foreign affiliates. Vertical spillovers can be grouped in backward and forward linkages. Backward linkages measure the spillovers from the presence of foreign firms downstream and

represent the weighted share of foreign capital from all sectors that are supplied by the sector considered. Forward linkages measure the spillovers from the presence of foreign firms upstream and represent the weighted share of foreign capital from all sectors that supply the sector considered. Weights in backward and forward linkages are the share of the sector output used as intermediate inputs by another sector.

Although empirical evidence of the existence of spillovers, particularly horizontal spillovers is mixed, a recent literature based on firm-level studies highlights the evidence of higher productivity in the supplying industries due to the presence of foreign ownership in the downstream sectors (Blalock and Gertler, 2004 in Indonesia; Javorick, 2004 in Lithuania, and Javorick and Spatareanu, 2008 in Romania). This new literature uses firm-level data for the estimation of productivity, but spillovers proxies are still defined at the sector-level. Sector-level information could hide significant heterogeneity between firms in the sector. Indeed, interaction between foreign firms and local companies could be limited only to the biggest local firms, which are, on average, the most productive local firms in each sector. Instead of using sector-level information to assess the importance of business between foreign and local companies, this chapter uses, for the first time, newly available data on the exact sales of each firms to multinational companies located in the country to proxy the extent of vertical spillovers, precisely a "backward linkage"[92]. Firstly, we do this for all firms and then restrict our sample to the local firms and then to the small-local firms as robustness checks. Information on the share of firms' sales directed to multinationals in the country has the advantage to capture the exact extent of cooperation at firm-level with foreign companies located in the economy. This allows us to control for potential heterogeneity of spillovers within different sectors. The following table gives the results from the analysis of the effect of backward linkages on firm productivity.

[92] This study does not claim to be a substitute to panel data analyses but rather a complementary approach proposing a more precise proxy for vertical (backward) vertical spillovers.

Table 5.5: Sales to multinationals and firm-level inefficiency

	Dependent Variable: ln(Value added)				
	(1)	(2)	(3)	(4)	(5)
Production Function					
Ln(capital)	0.199	0.178	0.178	0.177	0.173
	(34.22)***	(29.00)***	(28.95)***	(28.85)***	(28.24)***
Ln(labor)	0.797	0.743	0.743	0.742	0.739
	(98.43)***	(67.01)***	(67.03)***	(66.75)***	(66.39)***
Constant	1.892	2.596	2.626	1.962	2.710
	(12.00)***	(12.88)***	(12.75)***	(14.05)***	(12.59)***
Investment Climate *(Investment climate variables are regressed on firm-level inefficiency)*					
Size	-2.535	-0.146	-0.145	-0.149	-0.146
	(5.57)***	(7.77)***	(7.74)***	(7.84)***	(8.22)***
Age	-0.045	-0.001	-0.001	-0.001	-0.001
	(1.44)	(0.98)	(0.98)	(1.07)	(1.43)
Sales to multinational	-0.078	-0.002	-0.002	-0.002	-0.002
	(2.46)**	(3.50)***	(3.51)***	(3.50)***	(3.12)***
Informal finance		0.002	0.002	0.002	0.002
		(3.35)***	(3.40)***	(3.36)***	(3.40)***
Electricity problem		0.218	0.218	0.216	0.212
		(3.55)***	(3.63)***	(3.48)***	(3.54)***
Workforce education		-0.009	-0.009	-0.009	-0.009
		(7.16)***	(7.15)***	(6.94)***	(7.34)***
Property rights protection		-0.029	-0.029	-0.030	-0.020
		(1.66)*	(1.64)	(1.68)*	(1.17)
Regulation Management			0.004	0.004	0.004
			(1.50)	(1.55)	(1.82)*
Export (% of sales)				-0.000	-0.000
				(0.71)	(0.18)
Foreign Firm					-0.176
					(3.76)***
Constant	-4.071	1.199	1.190	1.186	1.218
	(2.68)***	(6.49)***	(6.44)***	(6.34)***	(6.32)***
Observations	7622	7403	7403	7387	7375
sigma_u	*2.27*	*0.35*	*0.35*	*0.35*	*0.34*
	[0.71]	*[0.17]*	*[0.17]*	*[0.17]*	*[0.17]*
sigma_v	*0.62*	*0.62*	*0.61*	*0.61*	*0.62*
	[0.10]	*[0.15]*	*[0.16]*	*[0.15]*	*[0.16]*
Wald chi2	36050.72	14382.33	14121.22	13720.07	13507.58
Prob > chi2	0.00	0.00	0.00	0.00	0.00

Absolute value of z statistics in parentheses. Number in brackets for sigma_u and sigma_v are standard errors. * significant at 10%; ** significant at 5%; *** significant at 1%

All regressions include year, country, and sectoral dummies.

Sale to multinational is the percentage of firm sales to domestic multinational. All investment climate variables are industry-region averages by capital ownership except informal finance variable which is firm-level information.

Investment climate variables are still significant determinants of firm level productivity similarly to the previous sections. The higher are firms' sales to the multinationals in the country, the more productive these firms are. This result illustrates higher productivity level of firms supplying the foreign companies. Improvement of productivity of foreign firms' suppliers could be the consequences of higher requirement in term of standard, timing and quality of products by foreign firms to their local suppliers. Since foreign companies will benefit from better productivity of their local suppliers, multinational firms could deliberately transfer knowledge, new technologies and production processes to their local partners. The positive relationship between firm-level productive efficiency and the share of their sales to local multinationals could thus be interpreted as firms improve their productive performances by doing business with foreign companies. With the entry of foreign firms in the local markets and their higher requirement in term of product quality, low-performer local firms that are not able to respond to this new demand could be crowded-out from the market. This could be problematic if this market selection of firms supplying multinational companies leads to the exclusion of local firms or small firms. In this case, aggregate productivity could still increase but big and foreign-owned firms will drive this. Given the potential and the importance of small and local firms in creating jobs in developing countries, exclusion of those firms could have negative impact on local employment. Our baseline regressions include firm size as well as a foreign ownership variable to control for these two aspects. Regardless of firms' size and foreign participation in their capital, firms selling higher part of their production to multinationals exhibit higher productivity. Additional robustness checks based exclusively on a sample of local firms and small-local firms confirms the results (appendix 4).

Local firms and small-local firms doing business with foreign firm located in the country have on average higher productivity. Even with the restricted sample of local and small-local firms, selectivity problem could still arise. Indeed, higher competition induced by demand from multinational companies could lead to the exit of non-productive local and small firms and the new entry of more productive

local and small firms into the market. This possibility highlights the potential simultaneity bias in our results. It is worth noting that the direction of the causality does not matter in our case. Either local firms are more productive because of technology or production processes sharing with foreign firms or because of the drop-out of local non-efficient firms and the entry of new, more productive local firms, the impact of doing business with foreign firms is positive for the aggregated local firms and the aggregate economy at large.

6. Conclusion

This chapter has analyzed productive performance for the manufacturing industry by considering the "one step" Stochastic Frontier Analysis (SFA) where production technology and efficiency determinants are simultaneously estimated. Efficiency scores are equivalent to a relative productivity measure, with efficient firms providing the benchmark. Across the five countries we investigated using the World Bank's *Investment Climate Assessment* databases, average productivity scores broadly reflect international per capita GDP differences. In other words, South Africa and Brazil exhibit the highest average productivity. The variance of inefficiencies depends on some factors proceeding from the quality of firm organizations but also from the external environment they face with regards to the economic and institutional dimensions. Particular attention is given to foreign ownership as the aim of this chapter is to use a new approach to explain why foreign firms are more productive than local ones. This approach proposes the difference in the investment climate faced by foreign and local firms as a main factor contributing to the higher productivity of foreign firms. An innovative way to assess the extent of vertical spillovers from foreign firms to local companies is also explored.

The results show that returns to scales are relatively constants, legitimating the hypothesis underlying the non-parametric total factor productivity measures. The estimations confirm that differences in the investment climate highly contribute to the technical efficiency differences. To explain disparity in industrial performances, we first focus on the role of four measures of the investment climate. We show that differences in the quality of infrastructure, in the level of education of the labor

force, in access to finance, as well as in two dimensions of the institutional quality significantly explain productivity disparities. Similarly with Dollar et al. (2006), the variation across firm location within a country of institutional variables is a significant determinant of inefficiency scores. Bigger firms also tend to be the more productive. These findings show that, in the global economy where technology diffuses more rapidly and capital is more mobile, the persistence of productivity differences among countries can be partially explained by differences in the investment climate.

In particular, we show that higher productivity of foreign firms can be explained by the better investment climate they face compared to local companies. Indeed, foreign firms can influence positively their investment climate or locate where investment climate is better. While investment climate matters for firms' productivity on average, foreign firms productive performances are not negatively influenced by the local investment climate constraints. Adjusted efficiency to the best investment climate in each country -the investment climate faced by foreign firms- highlights efficiency gains ranging from less than 10% in South Africa to about 25% in Pakistan.

Based on firm-level information, we also find evidence of vertical spillovers from foreign firms to the local ones. Contrary to the past studies in which the spillovers effects are estimated at sector-level, we use, for the first time, the share of each firm's sales to multinationals located in the country to assess the importance of the spillovers. We find that firms, and particularly local and small-local firms, selling part of their production to foreign firms exhibit higher productivity. This confirms the existence and importance of vertical spillovers through backward linkages in our sample countries.

The results support the idea that deficiencies in the investment climate can be at the origin of a loss of domestic and international competitiveness. The results show, therefore, that enhancing investment climate constitutes a powerful engine for better productivity and competitiveness of the manufacturing industry, facilitating the long-run convergence process. Another interesting finding can be seen in the

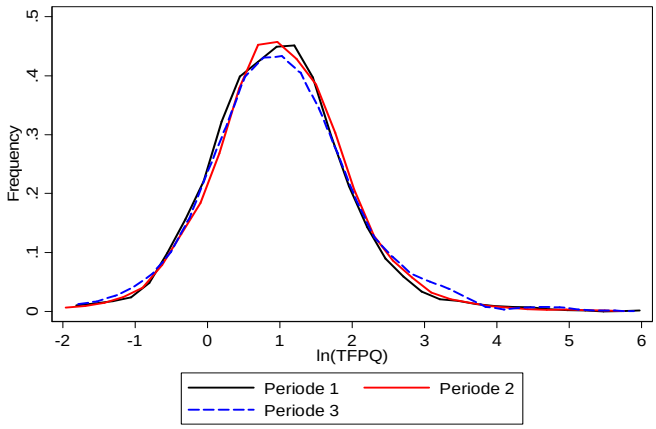
fact that the impact of the investment climate is statistically stronger for small and medium (under 150 workers) domestic firms. Big and foreign firms thus have the possibility to positively influence their investment climate, and/or settle in locations where the investment climate is better. Improvement of the investment climate of small and medium enterprises would generate substantial productivity gains and largely boost the competitiveness of this category of firms. This outcome should be considered as highly relevant, considering the importance of small enterprises in developing countries, as well as their huge potential of job creation. The integration of a higher share of foreign firms into the world market also increases the aggregate productivity and particularly the productivity of local firms through spillover effect. Policies aiming to attract foreign firms thus have beneficial effects not only by financing saving gaps in countries but also by boosting recipient countries aggregate productivity. The relatively limited number of countries in this chapter (5 countries) calls for cautious when interpreting the results for developing countries.

Developing countries are increasingly concerned about improving their competitiveness and productivity, as they face the intensifying pressure of globalization. The World Bank firm-surveys provide a standard instrument for identifying key obstacles to firm-level performances and prioritize policy reforms in order to boost competitiveness and diversify economies.

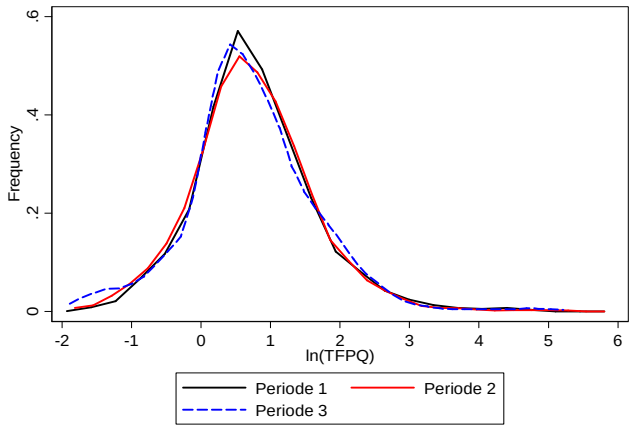
Appendices

Appendix 5.1: Distribution of productivity across three consecutive years

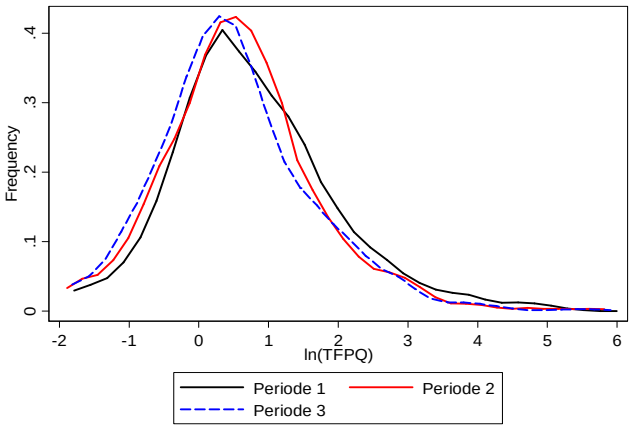
Brazil



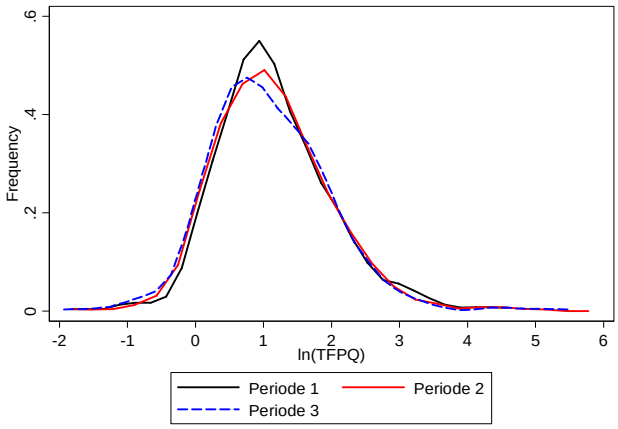
Morocco



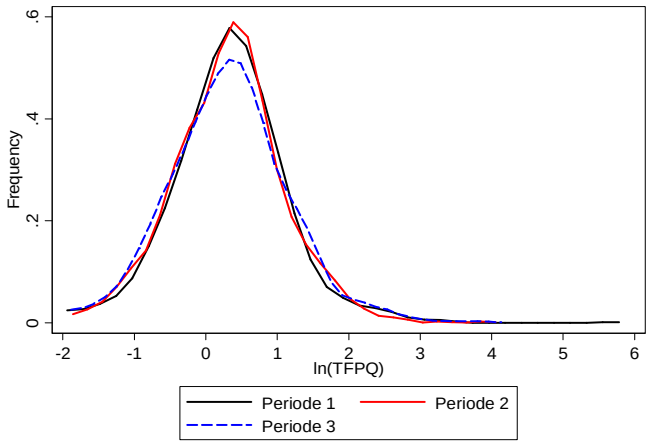
Pakistan



South Africa



Vietnam



Appendix 5.2: Investment Climate and Firm-level Inefficiency

(No control for firms' specific characteristics)

	Dependent Variable: ln(Value added)					
	All firms				***Small local firms***	
	(1)	(2)	(3)	(4)	(5)	(6)
Production Function						
Ln(capital)	0.213	0.213	0.213	0.213	0.204	0.204
	(43.48)***	(43.57)***	(43.51)***	(43.48)***	(33.54)***	(33.46)***
Ln(labor)	0.775	0.774	0.776	0.775	0.738	0.734
	(123.94)***	(123.97)***	(122.83)***	(123.88)***	(81.92)***	(81.78)***
Constant	1.225	1.221	1.220	1.220	1.401	1.380
	(22.24)***	(21.59)***	(22.08)***	(22.17)***	(19.43)***	(17.85)***
Investment Climate *(Investment climate variables are regressed on firm-level inefficiency)*						
Informal finance	0.043		0.037	0.041	0.056	0.041
	(5.44)***		(6.19)***	(5.41)***	(4.12)***	(3.72)***
Informal finance^{+}		0.059				
		(5.22)***				
Electricity problem	1.560	1.264	1.423	1.388	5.040	3.190
	(1.96)*	(1.78)*	(2.12)**	(1.72)*	(2.79)***	(2.17)**
Workforce Education	-0.212	-0.208	-0.178	-0.225	-0.386	-0.365
	(5.25)***	(6.15)***	(5.95)***	(5.92)***	(4.03)***	(4.26)***
Property Rights	-2.547	-2.300	-2.120	-2.561	-3.336	-2.879
	(7.16)***	(9.20)***	(9.04)***	(8.89)***	(5.36)***	(5.82)***
Labor Regulation			-0.012		-0.096	
			(1.07)		(3.13)***	
Regulation Management				0.042		0.057
				(2.14)**		(2.17)**
Constant	-2.798	-2.281	-1.067	-3.098	-0.240	-7.287
	(1.86)*	(1.73)*	(0.68)	(2.06)**	(0.06)	(2.63)***
Observations	12650	12697	12647	12650	8741	8746
sigma_u	*2.00*	*1.91*	*1.82*	*2.03*	*2.35*	*2.18*
	[0.70]	*[0.52]*	*[0.50]*	*[0.58]*	*[0.93]*	*[0.80]*
sigma_v	*0.67*	*0.67*	*0.67*	*0.67*	*0.70*	*0.70*
	[0.09]	*[0.09]*	*[0.09]*	*[0.09]*	*[0.11]*	*[0.11]*
Wald chi2	60808.67	60674.86	59766.51	60685.64	21749.55	21637.58
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00

Absolute value of z statistics in parentheses. Number in brackets for sigma_u and sigma_v are standard errors.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include year, country, and sectoral dummies.
All investment climate variables are industry-region averages by size and capital ownership except informal finance variable which is firm-level information. Informal finance^{+} is industry-region averages by capital ownership.

Appendix 5.3: Investment Climate, Foreign Ownership and Firm-level Inefficiency

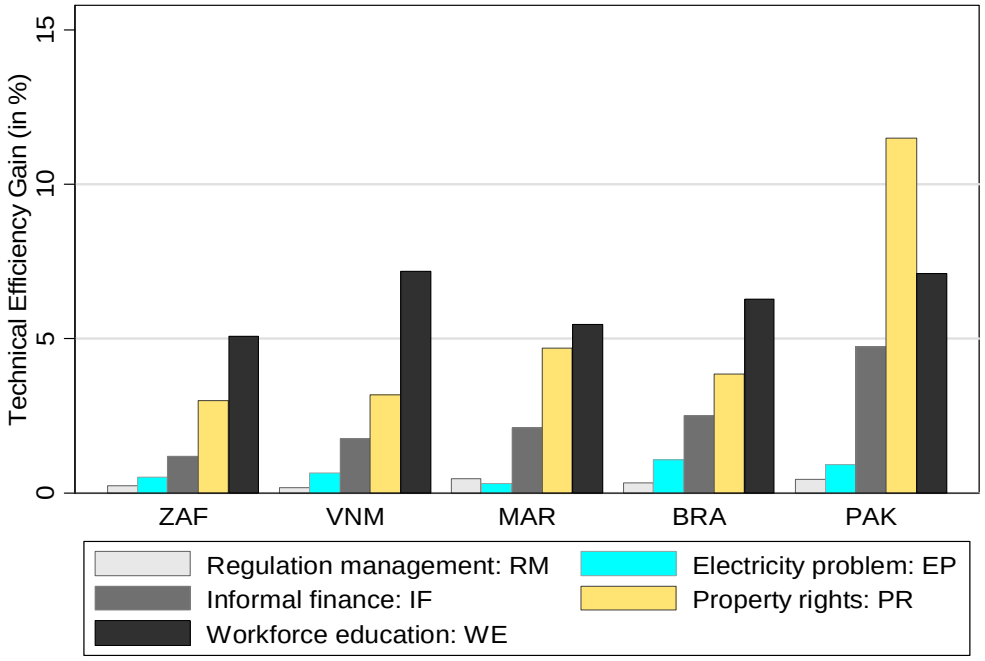
(No control for firms' specific characteristics)

	Dependent Variable: ln(Value added)			
	(1)	(2)	(3)	(4)
Production Function				
Ln(Capital)	0.217	0.213	0.212	0.213
	(44.18)***	(43.48)***	(43.32)***	(43.57)***
Ln(Labor)	0.777	0.775	0.775	0.767
	(126.36)***	(123.88)***	(123.62)***	(120.21)***
Constant	1.243	1.220	1.232	1.285
	(23.08)***	(22.17)***	(21.67)***	(23.01)***
Investment Climate *(Investment climate variables are regressed on firm-level inefficiency)*				
Foreign Firm	-6.626		-4.292	-2.967
	(4.22)***		(3.01)***	(2.18)**
Export (% of sales)				-0.063
				(4.83)***
Informal Finance		0.041	0.041	0.040
		(5.41)***	(4.82)***	(5.03)***
Electricity Problem		1.388	1.426	1.581
		(1.72)*	(1.67)*	(1.77)*
Workforce Education		-0.225	-0.214	-0.227
		(5.92)***	(4.93)***	(5.65)***
Property Rights Protection		-2.561	-2.658	-2.572
		(8.89)***	(6.82)***	(8.21)***
Regulation Management		0.042	0.043	0.043
		(2.14)**	(2.07)**	(2.07)**
Constant	-11.439	-3.098	-3.162	-3.582
	(10.78)***	(2.06)**	(1.94)*	(2.16)**
Observations	12898	12650	12635	12527
sigma_u	*2.10*	*2.03*	*2.08*	*2.15*
	[0.55]	*[0.58]*	*[0.75]*	*[0.63]*
sigma_v	*0.68*	*0.67*	*0.67*	*0.67*
	[0.10]	*[0.09]*	*[0.09]*	*[0.09]*
Wald chi2	66646.59	60685.64	59534.60	58411.08
Prob > chi2	0.00	0.00	0.00	0.00

Absolute value of z statistics in parentheses. Number in brackets for sigma_u and sigma_v are standard errors.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include year, country, and sectoral dummies.
All investment climate variables are industry-region averages by size and capital ownership except informal finance variable which is firm-level information.

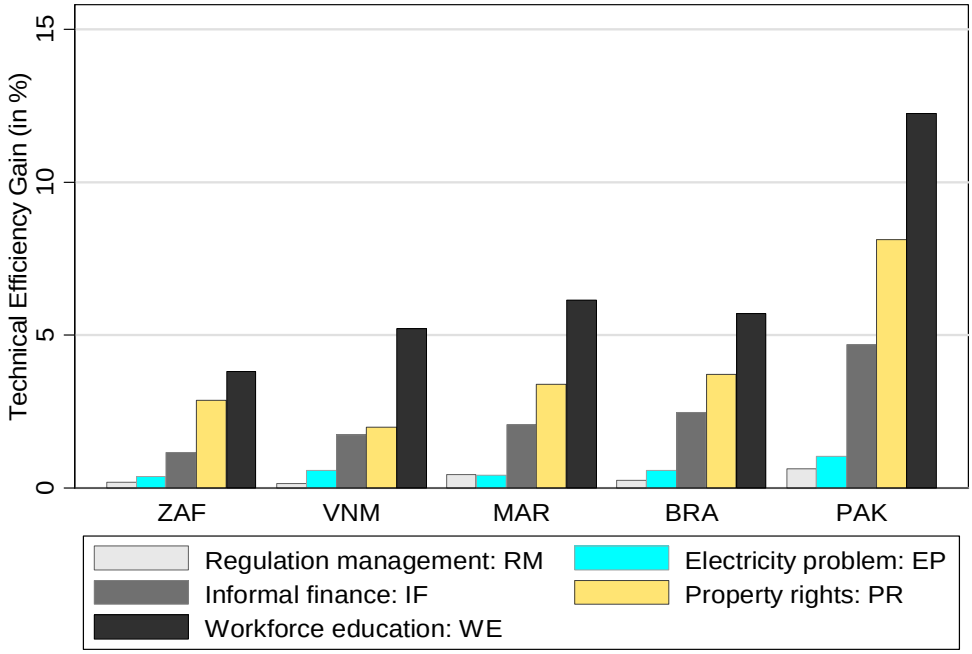
Appendix 5.4: Projection to the best environments by sector within the country

(Translogarithmic function)



Projection to the best environments within the country (all sector)

(Translogarithmic function)



Appendix 5.5: Table 4: Sales to Multinationals and Firm-level Inefficiency

(Robustness for small and local firms)

	Dependent Variable: ln(Value added)				
	All firms			***Local Firms***	***Small-Local Firms***
	(1)	(2)	(3)	(4)	(5)
Production Function					
Ln(capital)	0.178	0.177	0.173	0.192	0.168
	(28.95)***	(28.85)***	(28.24)***	(31.03)***	(22.64)***
Ln(labor)	0.743	0.742	0.739	0.792	0.726
	(67.03)***	(66.75)***	(66.39)***	(90.92)***	(57.82)***
Constant	2.626	1.962	2.710	1.813	1.565
	(12.75)***	(14.05)***	(12.59)***	(11.20)***	(23.18)***
Investment Climate *(Investment climate variables are regressed on firm-level inefficiency)*					
Size	-0.145	-0.149	-0.146	-1.746	-0.197
	(7.74)***	(7.84)***	(8.22)***	(5.16)***	(6.57)***
Age	-0.001	-0.001	-0.001	-0.011	-0.000
	(0.98)	(1.07)	(1.43)	(0.53)	(0.14)
Sales to multinational	-0.002	-0.002	-0.002	-0.041	-0.005
	(3.51)***	(3.50)***	(3.12)***	(1.90)*	(2.61)***
Informal finance	0.002	0.002	0.002	0.019	0.001
	(3.40)***	(3.36)***	(3.40)***	(1.64)	(1.03)
Electricity problem	0.218	0.216	0.212	0.690	0.060
	(3.63)***	(3.48)***	(3.54)***	(0.41)	(0.50)
Workforce education	-0.009	-0.009	-0.009	-0.183	-0.017
	(7.15)***	(6.94)***	(7.34)***	(4.47)***	(6.29)***
Property rights protection	-0.029	-0.030	-0.020	-0.638	-0.087
	(1.64)	(1.68)*	(1.17)	(1.61)	(2.92)***
Regulation Management	0.004	0.004	0.004	-0.016	-0.001
	(1.50)	(1.55)	(1.82)*	(0.20)	(0.23)
Export (% of sales)		-0.000	-0.000	-0.047	-0.109
		(0.71)	(0.18)	(1.47)	(4.20)***
Foreign firm			-0.176		
			(3.76)***		
Constant	1.190	1.186	1.218	-0.366	1.422
	(6.44)***	(6.34)***	(6.32)***	(0.09)	(4.72)***
Observations	7403	7387	7375	6786	5022
sigma_u	*0.35*	*0.35*	*0.34*	*1.93*	*0.30*
	[0.17]	*[0.17]*	*[0.17]*	*[0.56]*	*[0.14]*
sigma_v	*0.61*	*0.61*	*0.62*	*0.60*	*0.65*
	[0.16]	*[0.15]*	*[0.16]*	*[0.10]*	*[0.13]*
Wald chi2	14121.22	13720.07	13507.58	29619.19	9186.57
Prob > chi2	0.00	0.00	0.00	0.00	0.00

Absolute value of z statistics in parentheses. Number in brackets for sigma_u and sigma_v are standard errors. * significant at 10%; ** significant at 5%; *** significant at 1%

All regressions include year, country, and sectoral dummies.

Sale to multinational is the percentage of firm sales to domestic multinational. All investment climate variables are industry-region averages by capital ownership except informal finance variable which is firm-level information.

General Conclusion

The importance of private capital flows in financing development is crucial, particularly in a context of limited and instable public flows. Beyond their economic benefits, capital inflows also tend to generate or exacerbate macroeconomic overheating, loss of competitiveness and vulnerability to financial crisis. Given the contentious conclusions of the empirical literature on these issues, it is important to reassess them. This dissertation analyzed the main determinants of private capital flows, the consequences of these flows on countries' competitiveness and a policy response in presence of private flows. The dissertation addressed empirically three main questions: How developing countries could attract more private capital flows? What are the consequences of private inflows on countries' competitiveness, measured by the real exchange rate and firms' productivity? Can any policy response offset the impact of private flows on the real exchange rate?

The first part of the dissertation analyzes the determinants of private capital flows (FDI and portfolio investment) from a macroeconomic perspective. Additionally, a microeconomic insight, based on firm-level data and focusing on the determinants of FDI completes the macroeconomic analysis. The second part of the dissertation focuses on the consequences of foreign capital on local economies through two chapters. The first one investigates the loss of competitiveness associated with the real exchange rate appreciation due to capital inflows and a potential policy response to dampen the real appreciation. The second chapter analyzes the positive impact of foreign investment on aggregate productivity.

The analysis of the macroeconomic determinants of private flows (chapter 2) shows that physical infrastructure and financial development positively affect FDI and portfolio investment in developing countries. The effect of financial development on portfolio investment is non-linear, indicating that lax monetary policy and

excessive credit provision could severely weaken the financial system and reduce portfolio investment inflows. For Sub-Saharan African countries, the analysis concludes that better physical infrastructure has a higher impact on FDI. A firm-level approach of the determinants of FDI reinforces the macroeconomic findings (chapter 3). This analysis shows that physical infrastructure problems, financing constraints, and institutional problems discourage FDI in the manufacturing sector. Foreign firms exporting their production are more affected by human capital constraints and physical infrastructure problems while foreign firm supplying the local markets are more affected by financing constraints. Trade and customs regulations encourage FDI, confirming the theory of horizontal FDI, according to which high trade barriers provide protection and price advantages to firms. In contrast with other developing countries, tax incentives do not appear to be relevant for the manufacturing sector in Sub-Saharan African countries.

The analysis of the impact of private flows on countries' competitiveness shows that public and private capital flows appreciate the real exchange rate, reducing countries' competitiveness (chapter 4). Among private flows, the real appreciation is higher for short-term flows such as portfolio investments compared to long-term flows (FDI and remittances). These results highlight the role of FDI in increasing productive capacity and more counter-cyclical remittances, smoothing consumption during slow economic activity. The flexibility of the exchange is an effective tool to dampen the appreciation of the real exchange rate due to capital inflows. Countries' competitiveness is also measured by their aggregate firm-level productivity (chapter 5). This analysis points out the better investment climate faced by foreign firms as a factor that significantly explain their higher productivity (compared to local companies). Aggregate efficiencies would considerably increase in a scenario where all firms face the investment climate faced by foreign firms. Local firms doing business with foreign companies are more productive. This validates the importance of vertical spillovers through backward linkages. It is worth noting that compared to the other chapters of the dissertation -which are based on a more representative sample of developing countries-, the relatively limited statistical base of this chapter

(five countries) calls for more caution when generalizing the results to all developing countries.

To summarize, this dissertation has showed that in order to attract private capital flows and benefit from these flows, developing countries should improve their investment climate. This implies promoting better infrastructure, finance, institution, and human capital. Particular attention should be given to human capital in countries aiming to attract foreign firms exporting their production and to financial development in countries looking for foreign firms that will serve the local market. A better cooperation between local firms and foreign companies could also help to magnify spillovers effects from foreign companies. Given their ineffectiveness, Sub-Saharan African countries should avoid tax incentives in their manufacturing sector. In defining their strategy to attract foreign capital, developing countries should first focus on long-term flows such as FDI and remittances given their lower potential of loss of competitiveness compared to short-term flows such as portfolio investments. Allowing some flexibility of the exchange rate helps countries to avoid the loss of competitiveness associated with capital inflows. Developing countries should also avoid lax monetary policy that could weaken the financial system and stop or reverse portfolio investments.

The policy responses to capital inflows depend on countries' characteristics (current account position, reserves level, exchange rate regime) and the causes of the inflows. This dissertation has analyzed one of the main policy responses: the exchange rate flexibility. In practice, developing countries often implement various policies during episodes of capital inflows. The management of private capital inflows to avoid a hard landing or a financial crisis in the aftermath of the inflows episode requires the coordination and the sequencing of diverse policies. These policies include macroeconomic measures such as sterilization (in the short-run), increase in reserve requirements, exchange rate flexibility, fiscal tightening, as well as structural measures such as financial sector reform with better banking supervision and

regulation, trade liberalization, and restrictive policies on flows. A comprehensive analysis of these policy options is important to understand how developing countries could wisely manage capital inflows and avoid the associated loss of competitiveness or financial crises.

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RESUME

Cette thèse analyse comment les pays en développement pourraient attirer davantage de capitaux privés, en bénéficier avec une amélioration de leur productivité, tout en évitant les éventuels effets pervers tel que l'appréciation du taux de change réel. La première partie de la thèse analyse les déterminants macroéconomiques des capitaux privés. Les résultats montrent que les infrastructures, et le développement financier favorisent les investissements directs étrangers (IDE) et les investissements de portefeuille (chapitre 2). La politique monétaire expansive réduit à terme les investissements de portefeuille. Une analyse des déterminants des IDE à partir de données de firmes renforce les résultats macroéconomiques (chapitre 3) en concluant qu'une meilleure qualité des infrastructures, des institutions et un développement financier stimulent les IDE dans le secteur manufacturier. Les firmes étrangères exportant leur production souffrent davantage des insuffisances de capital humain alors que les contraintes de financement sont des obstacles plus importants pour les firmes étrangères desservant le marché local. Contrairement aux autres pays en développement, les incitations fiscales ne semblent pas être utiles dans le secteur manufacturier des pays d'Afrique Sub-saharienne. La seconde partie de la thèse montre que les flux de capitaux privés et publics apprécient le taux de change de réel, réduisant la compétitivité des pays (chapitre 4). L'appréciation du taux de change réel est plus élevée pour les capitaux privés de court terme tels que les investissements de portefeuille relativement aux flux de long terme (IDE et transferts de migrants). La flexibilité du taux de change permet aux pays d'atténuer l'appréciation du taux de change réel émanant des flux de capitaux. Le climat d'investissement plus favorable des firmes étrangères explique significativement leur plus grande productivité par rapport aux firmes locales (chapitre 5). La productivité agrégée des pays est significativement améliorée lorsque toutes les firmes font face de façon hypothétique au climat d'investissement des firmes étrangères. Les firmes locales fournissant les firmes étrangères en matières premières ont une productivité plus élevée. Cela valide l'importance des spillovers verticaux au travers des liens fournisseurs-clients.

Mots clés: Flux de capitaux privés, Investissements Direct Etranger, Climat d'Investissement, Efficience des firmes, Spillovers Verticaux, Taux de Change Effectif Réel, Flexibilité du Taux de Change, Données de Panel, Triples Moindres Carrées, Frontière Stochastique, Estimateur de Moyenne de Groupe Agrégée, Pays en Développement.

ABSTRACT

This dissertation analyzes how developing countries could attract more private capital flows and benefit from these flows with higher productivity levels while avoiding some negative effects such as the appreciation of the real exchange rate. The first part of the dissertation analyzes the determinants of private flows from a macroeconomic perspective. The results show that infrastructure and financial development positively affect FDI and portfolio investment and that lax monetary policy significantly reduces portfolio investment (chapter 2). A firm-level analysis of the determinants of FDI strengthens the macroeconomic findings (chapter 3) and shows that better infrastructure, finance, and institutions stimulate FDI in the manufacturing sector. Human capital constraints are major obstacles for foreign firms exporting their production while financing constraints have more effect on foreign firms supplying the local market. In contrast with other developing countries, tax incentives do not seem to be successful in attracting capital flows to the manufacturing sector in Sub-Saharan African countries. The second part of the dissertation shows that public and private capital flows appreciate the real exchange rate, reducing countries' competitiveness (chapter 4). Among private flows, the real appreciation is higher for short-term flows such as portfolio investments than long-term flows (FDI and remittances). Exchange rate flexibility helps countries to dampen the appreciation of the real exchange rate stemming from capital inflows. A better investment climate for foreign firms significantly explains their higher productivity compared to local companies (chapter 5). Aggregate productivity would be significantly boosted if all firms face the investment climate of foreign firms. Finally, local firms supplying foreign companies with intermediate inputs exhibit higher productivity, highlighting the importance of vertical spillovers through backward linkages.

Keywords: Private Capital Flows, Foreign Direct Investment, Investment Climate, Firm-level Efficiency, Vertical Spillovers, Real Effective Exchange Rate, Exchange Rate Flexibility, Three Stage Least Square, Panel Data, Stochastic Frontier Approach, Pooled Mean Group Estimator, Developing Countries.